September 5, 1918 American Machinist Vol. 49, No. 10

The British 6-In. Howitzer

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Editor European Edition of the *American Machinist*

II. Machining and Inspection

This article describes the machining and heat-treating of the jacket, assembling the howitzer and the performance of other operations that are necessarily left until the A-tube and jacket have been assembled by shrinking. The author also gives an interesting description of fitting new A-tubes and otherwise repairing howitzers that have been worn and damaged in service.

THE jacket is received in the form of an untreated solid forging shown in Fig. 25. It is roughly 10 ft. long, 12 in. in diameter at the muzzle end, and 16 in. in diameter at the breech end, the weight being 43 cwt. (say 4800 lb.).

Operation 1.—Saw-off rough ends—This is done on a band-saw.

Operation 2.—Center muzzle end—This is done on a 12½-in. center (25-in. swing) lathe, the breech end being held in a four-jaw chuck and the muzzle end packed up level with the center of the machine. The muzzle end is then centered with a portable electric drill. Operation 3.—Turn muzzle end to run in steadyrest—The muzzle end is turned for a distance of 6 in. up, so that the jacket can be run in a three-jaw steady rest.

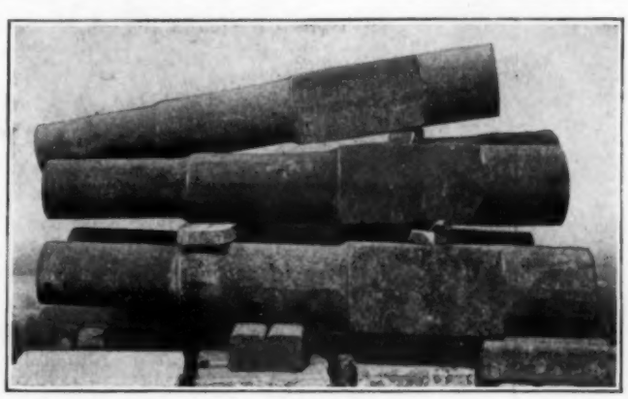


FIG. 25. JACKET FORGINGS

Operation 4.—Open out for rough and second bore—The jacket is held in a four-jaw chuck at the breech end and run in a three-point steadyrest at the muzzle end. The operation is started by drilling a 1½-in. hole for a distance of 6 in., which is opened out with an ordinary boring tool to 5½ in. in diameter for rough-boring. This is then again opened out to 7.9 in. in diameter for a distance of 3 in. for second-boring. This enables the rough and second boring heads to be properly guided when commencing these operations.

Operation 5.—Rough-bore—The jacket is bored 5½ in. from end to end, the same machine being used for this as for the A-tube, as fully described under A-tube, Operation 6.

Heat Treatment

The jacket now goes to the heat-treatment building and is put into the same furnace previously described under A-tube heat treatment.

Operation 6.—Anneal.

Operation 7.—Oil-harden.

Operation 8.—Temper—These operations are fully described under A-tube heat treatment in another part of the article.

The jacket has to pass the same tests for material as the A-tube before being returned to the machine shop for any further operations. Operation 9.—Part off test discs. Operation 10.—Cutting up test disks and machine test pieces.

Operation 11.—Pulling tests.

Operation 12.—Part off and face muzzle end to length.

Operation 13.—Part off and face breech end to length.

Operation 14.—Rough-turn—The rough-turning is done, as far as the guide feet will allow, in an ordinary lathe fitted with a suitable former shown in Fig. 26. The standard 1¼-in. high-speed-steel tools are used. The lathe, it should be explained, is a 12½-in.-center (25-in. swing) shell lathe packed up considerably, with a former device added at the back, hardened strips being bolted to a cast-iron bracket attached to the lathe bed. The former is of the single-sided type and positively controls the path of the tool. The roller on the cross-slide is prevented from leaving the former by a spring. Cutting speed is 22 to 30 ft. per minute; feed, 0.36 in. per minute; depth of cut, 1 inch.

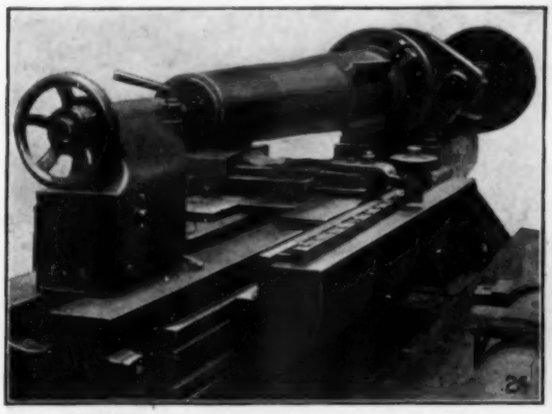


FIG. 26. ROUGH-TURNING JACKET

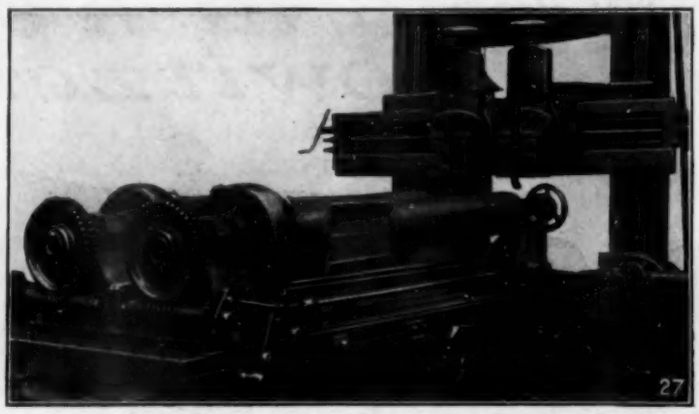


FIG. 27. ROUGH-TAPER-PLANING JACKET

Operation 15.—Mark off feet.

Operation 16.—Rough-taper-plane and rough out rear guide feet—This is done on a planing machine fitted with a twin taper-planing device as shown in Fig. 27. Each jacket is held in a bell chuck at one end and supported by a center at the other end. Rotary motion is given to the jacket by means of the worm and wormwheel at the end, the feed being put on automatically by means of a ratchet wheel and pawl worked from a special ramp (inclined block) on the side of the machine bed.

Operation 17.—Second-bore—In this operation the bore is opened out with one cut from 5½ in. in diameter to 7.9 in. in diameter. Cutting speed, 10 r.p.m.; feed, 0.1 in. per minute.

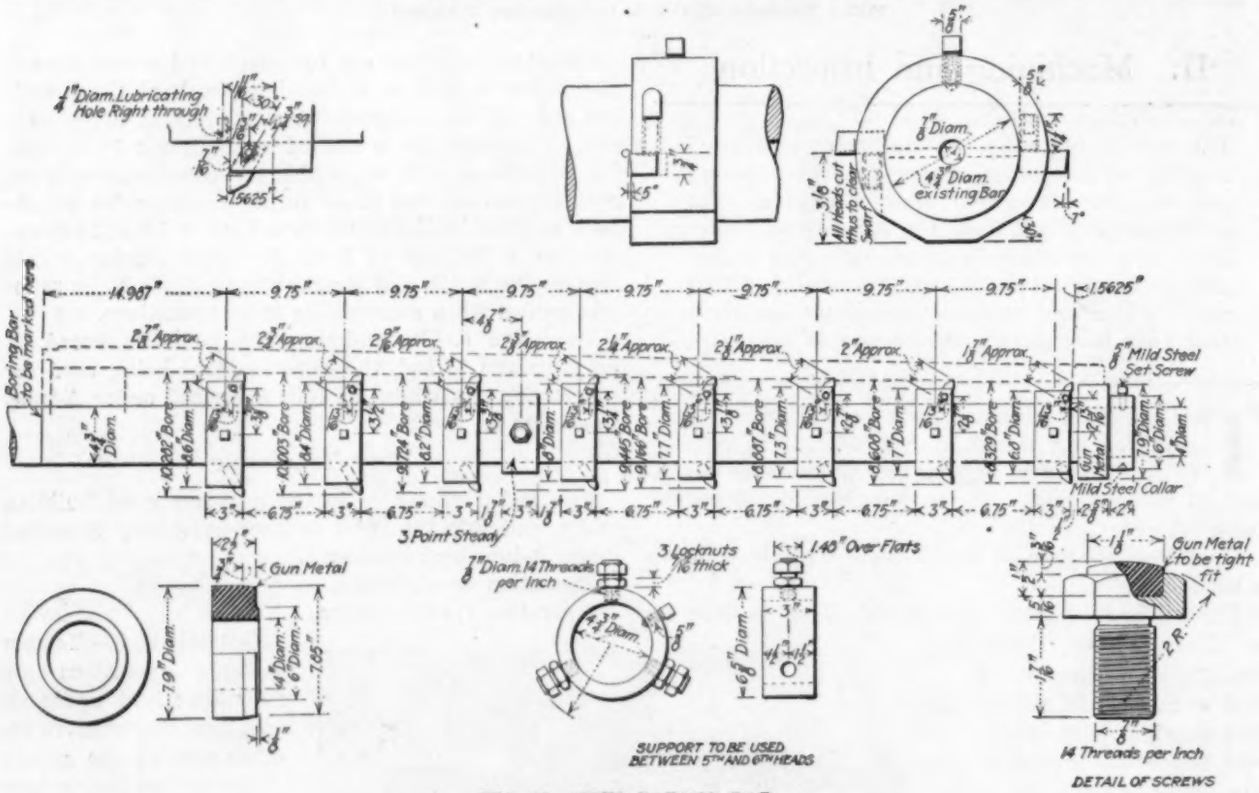
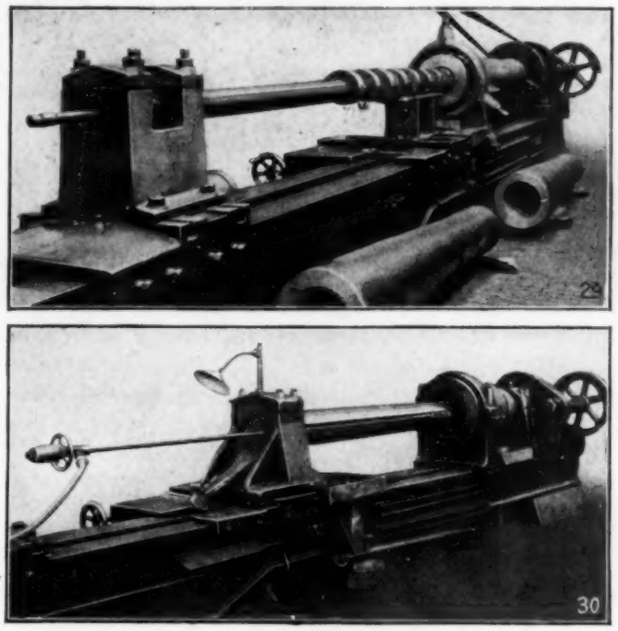


FIG. 28. STEP-BORING BAR

Operation 18.—Step-bore—The step-boring bar is arranged to carry cutters which bring the bore of the jacket to the diameters shown in detail in Fig. 28. The step-boring machine and the bar used are also shown in Fig. 29. From the illustrations it will be evident that the boring bar is made up of a steel bar 4⅞ in. in

diameter, on which are shrunk eight collars varying in diameter, each bearing two single-point boring tools, one on each side of the collar. The tools are of ¾-in.-sq. high-speed steel secured in the collar at an angle of 30 deg. with the face of the collar by means of a ⅝-in. setscrew. The front end of the bar is guided by a plain gun-metal ring of the same diameter as the second-boring size, while about midway is a three-point support. The collars are shaped to bear on a flat-top stool supported by the lathe bed. The bar is fitted up so that cutting compound can be delivered to each tool. On the floor in front of the machine will be seen two jackets which have been step-bored, and the stepping-down of the cut can be clearly seen. Cutting speed, 11 r.p.m.; feed, 0.13 in. per minute.



FIGS. 29 AND 30. BORING WORK
Fig. 29—Step-boring jacket. Fig. 30—Finish-taper-boring machine

Operation 19.—Open out for finish taper boring and face rear feet to length—The breech end is opened out to 11 in. in diameter to enable the finish-boring tool described in Operation 20 to be set and the cut started from this end. These are lathe operations.

Operation 20.—Rough and finish-taper bore—The machine used on this operation is shown in Fig. 30 and the details of the cast-iron bar, etc., are given in Fig. 31. As will be seen the bar has a longitudinal, dovetailed groove, in which slides a gun-metal carrier in which is fixed a single-point tool, ⅝ in. square, of high-speed steel. Motion is given to the carrier by means of a pipe conveying the cutting compound; this pipe is secured in a pedestal at one end, motion being given to the pedestal by means of a central screw and gearing as described in A-tube operation 6. The boring bar is secured at one end in the pedestal shown, the other end being carried in the special cone bearing in the end of the lathe spindle. Cutting speed, 8 r.p.m.; feed, 0.2 in. per minute.

Operation 21.—Bore muzzle end and draw back taper—This is done in another lathe, the breech end being held in a four-jaw chuck and the muzzle end run in a three-point steadyrest. The operation simply consists of finishing the taper bore up to the muzzle stop-ring shoulder in the jacket and boring for the muzzle stop ring.

Operation 22.—Finish-turn, face feet to length, and rough out for front guide ring—This operation is done between the centers from a former.

Operation 23.—Finish-taper-plane and rough-plane guide feet—This operation is similar in every respect to that described in jacket operation No. 16 except that usually only one jacket is on the machine at a time, as more attention is required during the finishing operations. The guide feet are planed for brass liners.

Operation 24.—Turn and screw for front guide ring—This is an ordinary turning and screw-cutting operation.

Operation 25.—Turn and screw for breech ring.

Operation 26.—Recess and screw for breech bush—This is an ordinary boring and internal screw-cutting operation, the breech end being run in a three-point steadyrest.

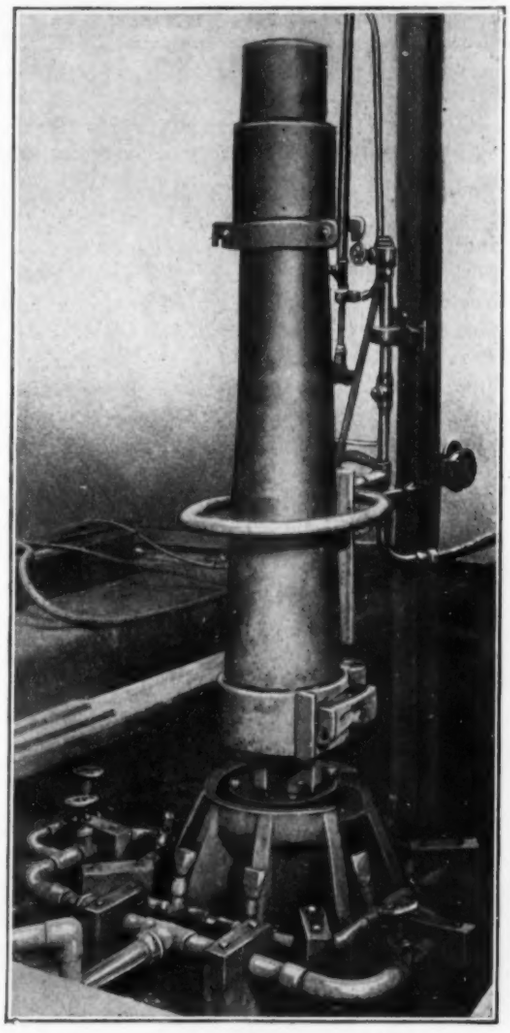


FIG. 32. SHRINKING ON THE JACKET

Operation 27.—Shrink jacket on A-tube—The A-tube and jacket are now taken to the shrinking pit. The A-tube is rigged up on a cast-iron stool and the jacket is placed in a gas-heated muffle furnace and raised to a temperature varying from 600 deg. F. to 650 deg. F. at the muzzle end. Lifted out of the furnace with the

crane by clips (clamps) placed under the front guide ring it is lowered over the A-tube until the collar enters the breech end of the jacket. The jacket is then lowered suddenly to insure the collar going right home onto the shoulder of the jacket. As soon as this is done the water is turned on in the cooling ring which is in position round the breech end of the jacket; this causes the jacket to contract suddenly round the collar of the A-tube and grip it fast. The water is kept on in this position for 3 min., by which time the breech end of the gun is cold. The ring is then raised gradually by means of a wire running over a pulley at the top of a stanchion until it reaches the muzzle end of the jacket. (Fig. 32). The time taken to cool the jacket is 12 minutes.

In order to check whether the face of the A-tube collar is in contact with the shoulder of the jacket the distance between the jacket shoulder and the muzzle-end face of the jacket is previously taken by means of a trammel and marked off on the A-tube by means of a center pop (punch); three more pops (punch marks) are then placed higher up the stop ring at distances $\frac{1}{10}$ in. apart. Then, after shrinking, the position of the A-tube collar in relation to the shoulder of the jacket can be determined by inspection of the center pops.

Operation 28.—Face-off muzzle end of A-tube and machine radii.

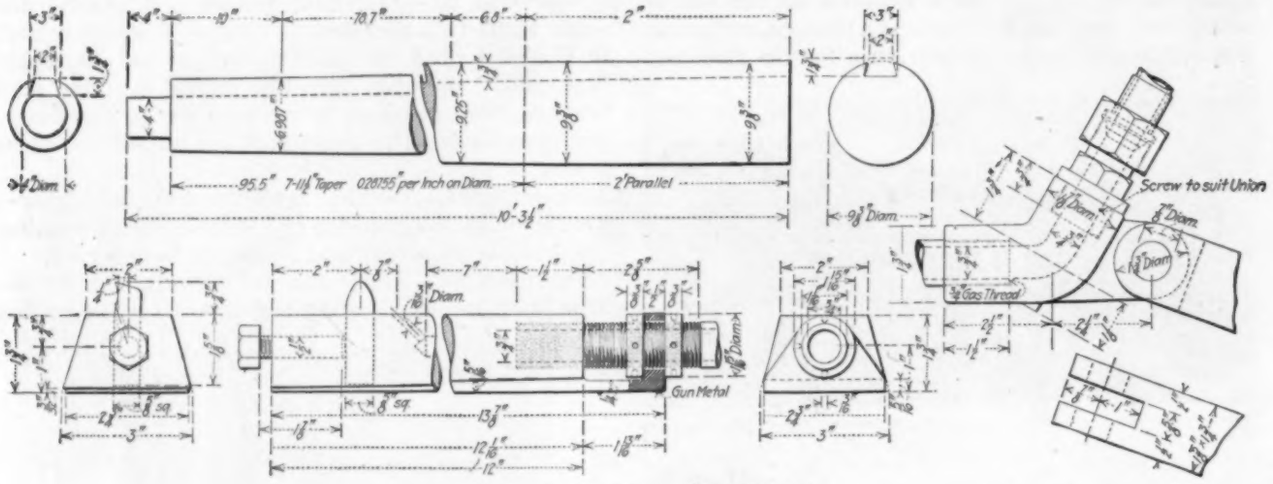
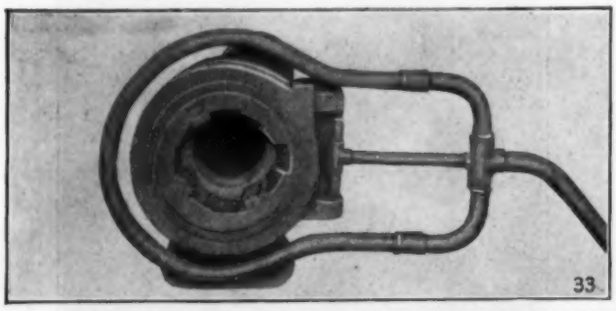
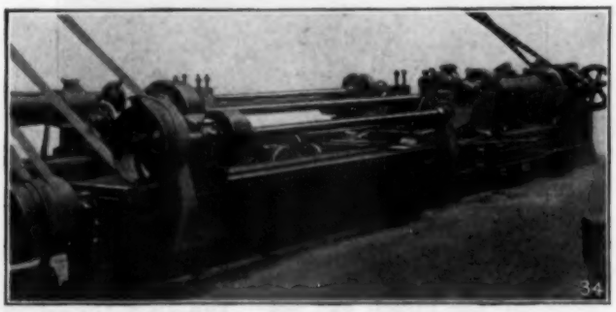


FIG. 31. BAR FOR TAPER-BORING





FIGS. 33 AND 34. HEATING AND LAPPING
Fig. 33—Heating appliance for front and breech guide rings.
Fig. 34—Lapping machine

Operation 29.—Face-off breech end—Both are lathe operations.

Operation 30.—Shrink on front guide ring—The jacket now goes to the shrinking pit to have the front guide ring shrunk on. To effect this the front guide ring is raised to 600 deg. F. in a heating ring. It is then screwed quickly onto the jacket and set to the center line already scribed on the jacket and the guide ring.

Operation 31.—Shrink on breech ring—This is done in exactly the same manner as the front guide ring (see Operation 30). The ring used for heating is shown in Fig. 33, which, however, shows the appliances in use for removing a breech bush.

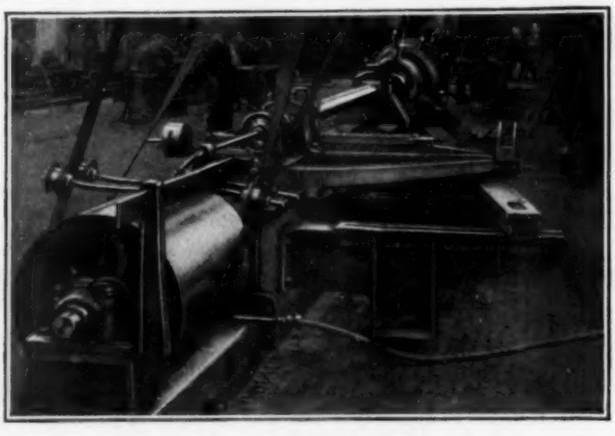


FIG. 36. RIFLING MACHINE

Operation 32.—Plane front and rear guide feet for brass liners—This is an ordinary planing operation; it is, however, very important that the jacket be set up true with the bore and with the piston holes in the breech ring.

Operation 33.—Bore chamber, cone and face to length—Here the jacket is held in a four-jaw chuck at the muzzle end and carried in a ring steadyrest at the

breech end. The chamber is bored by means of a bar fitted with a guide at the outer end which runs in the bore of the tube. By a slot cut through this bar in the required position the cutter can be inserted for forming the cone seating.

Operation 34.—Lap before rifling—The A-tube is lapped out to 5.95 in. in diameter in the machine shown in Fig. 34. The speed of the gun is 25 r.p.m., and of the spindle carrying the lapping head 50 r.p.m.; this spindle is driven by independent belts and gearing. The gun body is again held in a four-jaw chuck at the breech end and runs in a three-point steadyrest at the muzzle end. The lap is made in two halves of cast iron cored out so that lead may be run in. It is so constructed that it can be opened out when in the tube by means of the links shown clearly in Fig. 35, the angle of the links being controlled by means of a rod running through the lapping bar with a screw and handwheel at the operating end. The lap can be expanded about ½ in. and emery and oil are used in the process. Automatic reversing motion is obtained by the saddle of the machine operating a stop which throws either the open or the crossed belt into the driving position as required. The motion can also be reversed by hand with the lever and rod at the front of the machine, this being often necessary when bringing the tube to the correct diameter at any particular part of the bore. The bore of the tube is tested constantly during the lapping operation by means of a rock-over gage.

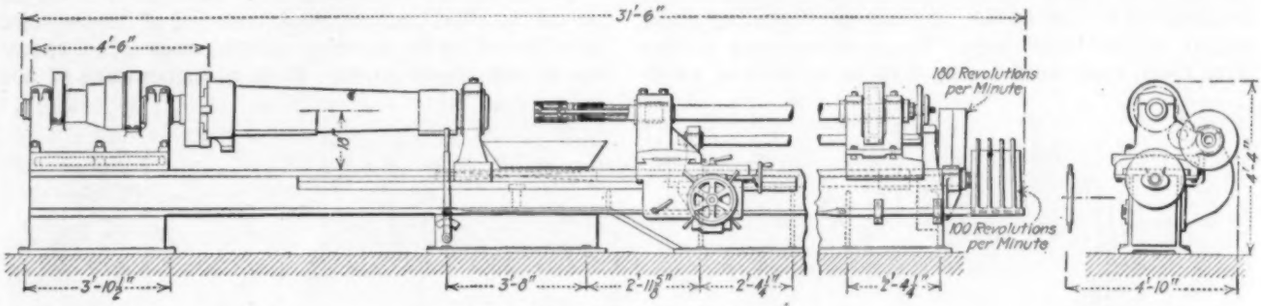


FIG. 35. LAPPING MACHINE

Operation 35.—Rifling—The rifling machine is shown in Figs. 36 and 37. The chuck at the stationary end of the machine carries the breech end of the jacket, the muzzle end being supported by the pedestal on the machine bed. The gun is set up true, longitudinally, by means of the rifling head, which is entered into the bore for that purpose. The rifling head is screwed on to the rifling bar, which is supported in bearings at each end and given a longitudinal motion along the bed of the machine by means of fast and loose pulleys geared with a central screw. The rotary motion which produces the helical groove is obtained in the usual way by a former at the back of the machine controlling the motion of a rack which moves across while the rifling head moves longitudinally, the rack gearing with a pinion on the rifling bar and producing the rotary motion. In the center of the rifling bar is a tube of case-hardened mild steel through which the cutting compound is led to the back of the rifling tools. In the end of this internal tube is a pin working on an inclined slot in the tool box, having a slope of 1 in 10. The longitudinal motion of this rod in one direction withdraws the cutters and in the opposite direction puts them into operation; the feed is adjusted by means of the handwheel or feed disk. This feed disk is revolved automatically by means of a right-angle lever and pawl acting on a ratchet wheel. The edge of the disk is marked off in thousandths, the usual feed being set at 0.003 in. In order to withdraw the cutter on the forward stroke and to place it in the operating position, which is on the return stroke, a two-armed weighted lever is supported on the carriage of the machine, one

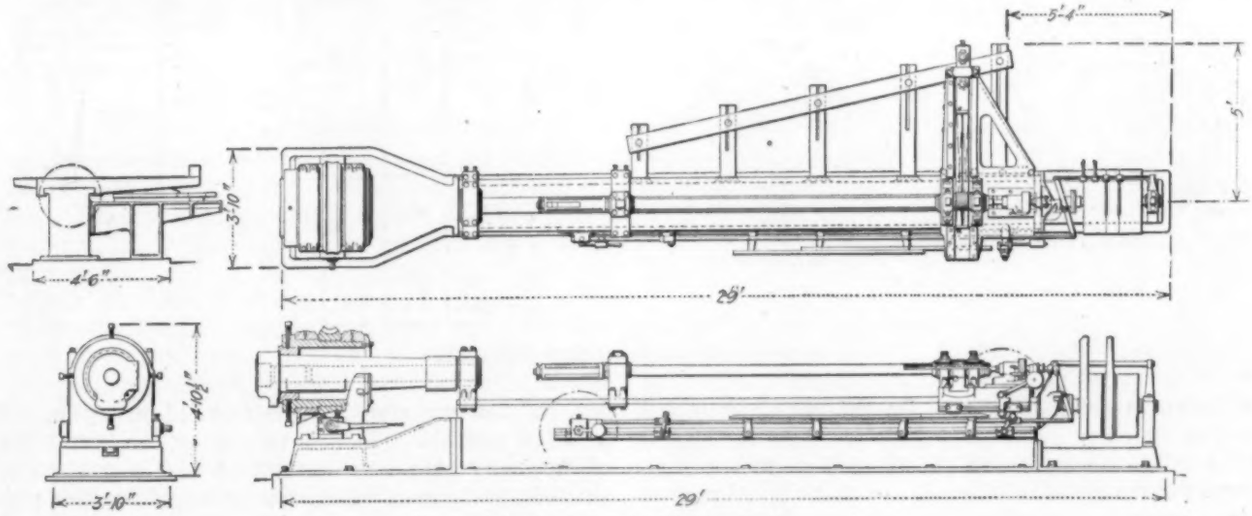


FIG. 37. RIFLING MACHINE

end of the lever bearing a roller which passes over a ramp (inclined block) on the front of the machine. On the forward stroke the roller, passing onto the ramp, swings the lever in an anticlockwise direction; this gives a forward motion to the feed rod running through the interior of the bar and so draws in the cutters to clear the rifling. On the cutting stroke the roller again comes in contact with the ramp and moves the lever in a clockwise direction, thus bringing the cutters to the required position. The reversal of the longitudinal motion of the carriage is effected by stops (dogs) in the usual way. The cutting head carries three tools, each 0.349 in. by 0.75 in. in section, as illustrated in detail, Fig. 38. On the rifling head will be seen four gun-metal bearing strips; these are backed by a mild-steel strip and are tapered so that adjustment for wear can be effected. In front is a brush to clear away the swarf (chips and dirt). During the machining process the depth of groove is taken by means of a finger gage, the wide lower end of which rests on the bore of the tube while the upper end is rocked into the groove. After the tools have cut one set of grooves the head of the machine is indexed round to the position for the next set by means of the worm and wormwheel shown in Fig. 37.

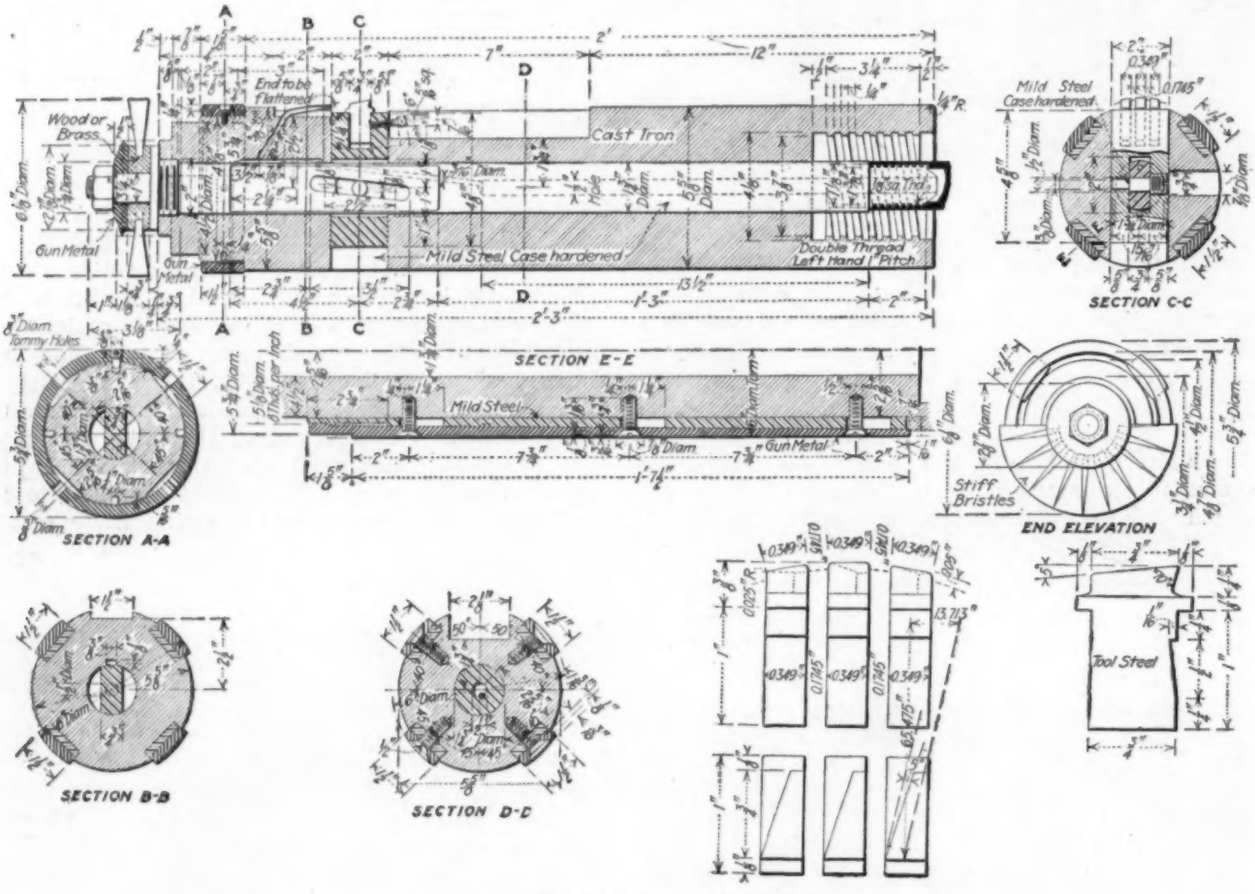


FIG. 38. DETAILS OF RIFLING HEAD

Operation 36.—Lap after rifling—The bore of the A-tube is now lapped out to 5.997 in. in the machine described under jacket operation No. 34. Besides removing any burs due to rifling this brings the bore to finished size.

Operation 37.—Take impressions—These are taken in gutta percha, which is melted down in a copper kettle to the necessary consistency and then spread by hand along an impression stick about 5 in. wide. This is inserted through the A-tube and wedges are driven in by mallet at each end. The gutta percha is then left to set, after which the wedges are removed and the impressions taken out, the edges trimmed up, and the strips put up on the bench for examination by the government inspector.

Operation 38.—Shrinking-in breech bush—This is done in the shrinking pit, the breech end of the howitzer being heated by the gas ring mentioned in jacket operation 31 and shown in Fig. 33 to a temperature of 500 deg. F. The gas ring is made from 1¼-in. piping and provided with 24 $\frac{3}{16}$-in. jets to play on the breech end of the jacket; the ring is supplied with a mixture of air and gas through an injector arranged for this purpose. The time is about 20 minutes.

Operation 39.—Drill feet for brass liners.

Operation 40.—Fit brass liners to guide feet.

Operation 41.—Plane brass liners on jacket—This is done on a planing machine and carefully gaged to size, the jacket being set true with the bore and with the piston holes in the breech ring. The liners are riveted to the feet by hand and planed in position.

Operation 42.—Drill holes in front guide ring for gravity tank—This is done from a jig shown in Fig. 39, which fits over the liners on the front guide ring. The position of the jig longitudinally is fixed by means of the plates covering each end of the guide feet.

Operation 43.—Fit dust covers—The dust covers that

bridge between the rear and front feet are of gun metal and are interchangeable. They are fitted to a jig shown in Fig. 40 and the holes are drilled for the fixing screws. The jig for drilling the corresponding holes in the front and rear guide-feet liners is also shown. The liners and dust covers are machined to thickness gages and to over-all gage (from one side of feet to the other) for width and to suit the body gage. The body gage *A* is afterward tried over the liners and plugs are tried through the piston holes in breech ring and the corresponding holes in the jig to test correctness of brass liners. The interchangeability of the dust cover *B* (shown in jig) is insured by means of the jig shown on the same figure. The jig *C* is shown bridging between the front of the guide feet, and the bush through which the hole into the front and rear brass liners is drilled can be clearly seen at *D*. The jig that insures correctness of the dust cover is also shown with dust cover *B* inserted.

Operation 44.—Fit stop plates and dust liners—These are supplied by outside makers in the finished state and fixed in position by means of tapped holes and screws.

Operation 45.—Engraving.

Operation 46.—Clinometer adjusted to bore—The clinometer plane has to be very carefully scraped to render it perfectly true with the bore of the tube. Fig. 41 shows the clinometer adjusted. Axis lines are cut on the upper side and on the horizontal axis at breech and muzzle ends, horizontal and vertical axis lines being also cut on the breech and muzzle faces. A straightedge being placed through the bore and the gun leveled up the clinometer is then tried on the plane, which is scraped until true.

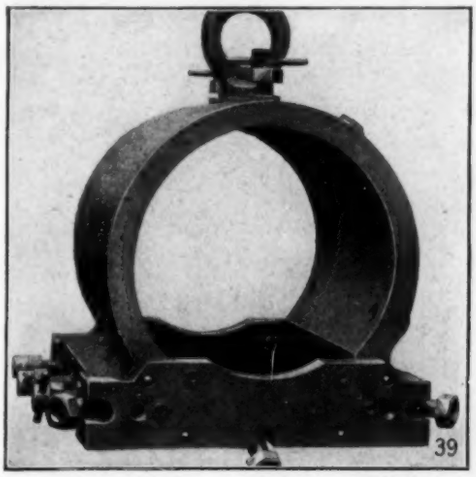
Operation 47.—Fit model breech mechanism and scrape cone to suit obturator (gas check) pad.

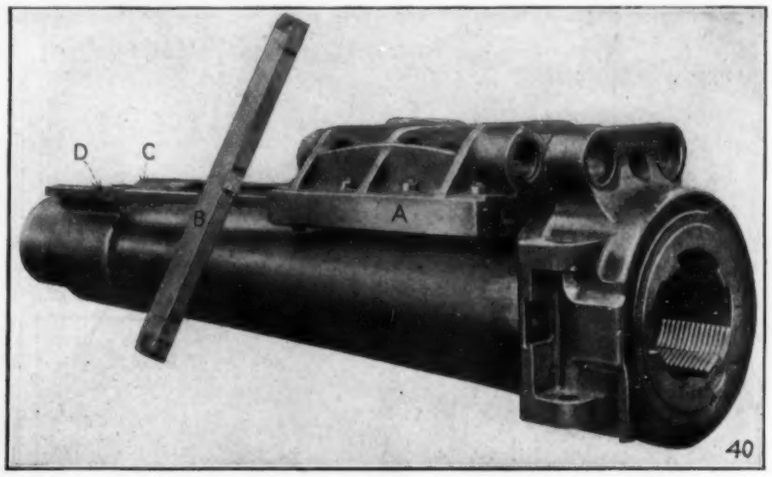
Operation 48.—Final assembling—This is done for inspection purposes so as to insure that the dust covers, arc-control mechanism, cam-rotating gear, breech mechanism, etc., are correct. These parts are then removed before sending the gun away to proof.

Worn and damaged howitzers are returned from the war zone in different stages of wear to be relined and repaired. The first thing done is to clean them thoroughly internally and externally; impressions of the rifling are taken and the bore is carefully gaged and recorded. These measurements and impressions are then handed over to the Woolwich inspecting officer, who goes over the howitzer and issues a sentence detailing the work required to render it again fit for service. A copy of an average sentence is given below:

To be fitted with a new A-tube to drawing....
Clinometer plane to be adjusted to bore and axis lines recut.
Breech-opening threads and hinge joints adjusted to model fittings.
To be fitted with new bearing strips and dust covers complete.
Cover plates to drawing....
Stop plates to drawing....
Recoil-indicator pointer complete to drawing....
Locking lines to be filled in with red wax.
Rust and burs removed from exterior and working parts.

This sentence is signed by the inspecting officer and issued by his department to the firm carrying out the repairs. Copies are then made and passed out to the departments concerned.





FIGS. 39 AND 40. VARIOUS JIGS AND GAGES
Fig. 39—Jig for drilling gravity-tank holes. Fig. 40—Body gage and jigs

Operation 1.—Remove old brass liners and dust covers.

Operation 2.—Remove old stop plates and dust liners.

Operation 3.—Remove breech bush—In order to remove the breech bush the breech end of the howitzer is heated up by means of the apparatus shown in Fig. 33, the temperature being raised to 500 deg. F.; the time required to reach this temperature is about 15 min. The bush is then rapidly cooled by means of an internal spray of water; it contracts and then can be easily screwed out.

Operation 4.—Knock out A-tube—To knock out the A-tube the howitzer is placed vertically on a cast-iron stool with the muzzle end uppermost; a gas-heating apparatus consisting of vertical 1¼ in. pipes is then rigged up round it as shown in Fig. 42. These pipes have jet holes the full length and are supplied with a mixture of gas and air through an injector.

The howitzer is then heated up to 550 deg. F., the time taken for this being 30 min. A tup (ram) is then lowered into the tube. This tup is made up of a cast-iron weight fitted to a piece of 5½-in. hollow-forged shaft. This shaft for the length of the A-tube is drilled with small holes spaced equally round its circumference. Water is conducted to the inside of the shaft by means of the flexible pipe and the connections shown. As soon as the tup is lowered into the tube

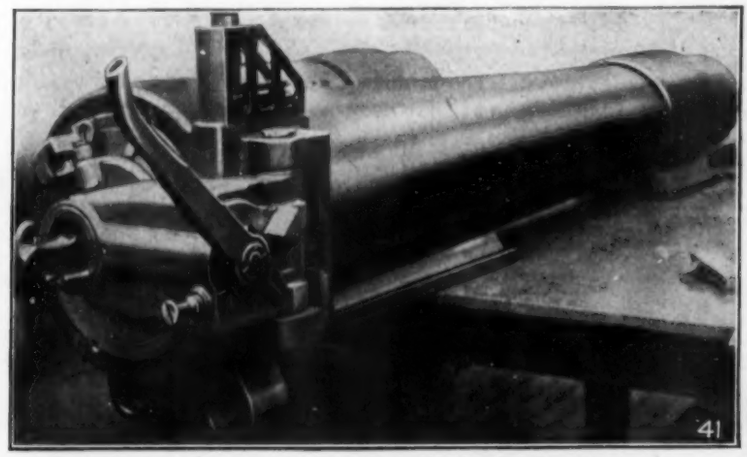
the water is turned on for a period of 5 min. This causes the tube to contract sufficiently to be easily tupped (driven) out. This is done by lifting the tup a distance of 3 ft. to 4 ft. and releasing it by pulling the rope attached to the drop catch. The tup falls, the collar on the shaft transmitting the blow to the muzzle end of the A-tube, which is almost invariably knocked out with one blow.

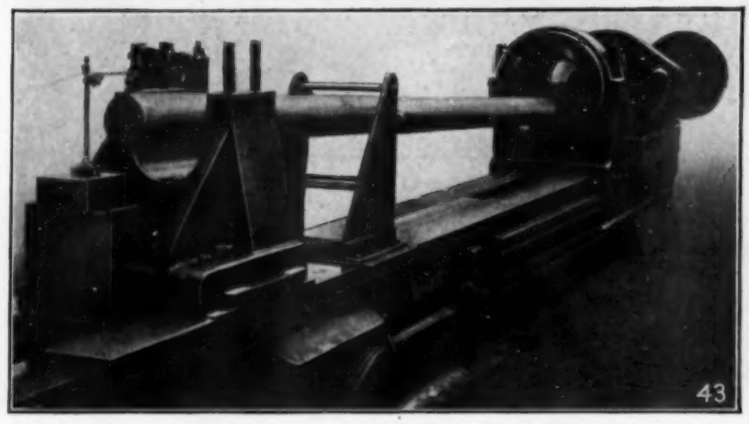
Operation 5.—True and skim up jacket—The A-tube being removed the jacket is set up in the machine shown in Fig. 43 and tested for straightness and truth of bore. The testing apparatus consists of a bar which is pivoted and supported from the lathe bed as shown. The end of the bar that enters the jacket carries a roller; this runs on the bore as the jacket is revolved so that any inaccuracy in the bore can be read off by means of a scribing block and indicator resting on the other end of the bar. The jacket is then trued up as near as possible, after which the testing bar is removed and the taper-boring bar inserted in the jacket, the taper-boring operation being fully described in jacket operation 20.

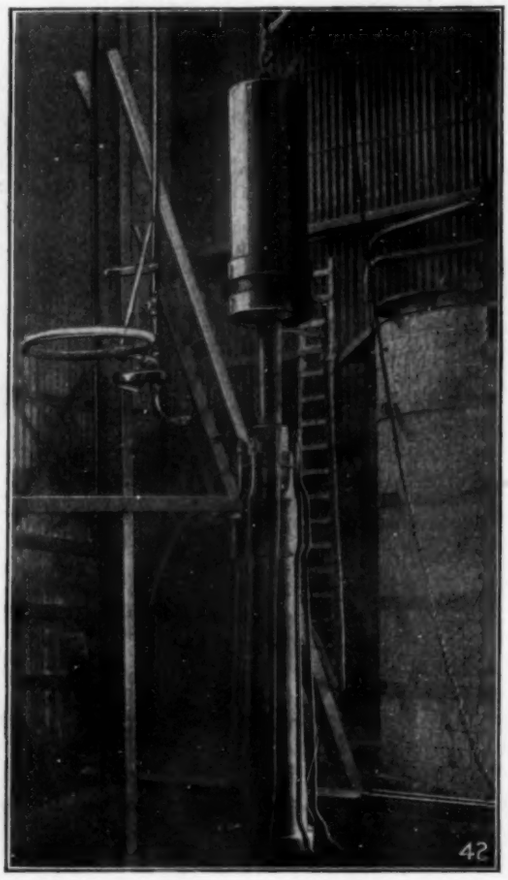
From this stage to the completion of the repair or relining the operations are identical with those described in the manufacture of new howitzers.

Important as inspection is in ordinary manufacturing, in gun production a satisfactory system is absolutely essential. Indeed in some directions a satisfactory system must needs seem elaborate in view of the fact that the measurements taken at one stage guide the measurements required at a later stage in connection more particularly with the wire winding of A-tubes and shrinking either of jackets or other parts in position.

The official gun inspection is carried out by the government through its inspecting officers working from the Royal Arsenal, Woolwich. Government examiners are stationed at the works under the immediate direction of the visiting inspector. All variations from plan, that is, drawing dimensions and authorized tolerances, have to be referred to the government inspection officer, who can exercise a certain amount of discretion as to whether the work may go forward to completion and proof or, alternatively, can refer the matter back to his superior for final decision.







FIGS. 41 TO 43. TUBE AND JACKET WORK
Fig. 41—Clinometer adjusted. Fig. 42—Removing an A-tube. Fig. 43—Test bar for truing up jacket

The firm has an inspection department, the function of which is to be an intermediary between production and the government inspection and to insure that the proper standard of manufacture is maintained in every operation. This is necessary because of the importance of only making piecework payments for work properly done and also because the government inspection is in the nature of inspection at certain stages more than an inspection by operations, for it is imperative that any error in work should be discovered at the earliest moment, and this can be insured only by a firm making its own inspection arrangements.

The firm's inspection arrangements necessarily reflect and embody the requirements of the government inspection, and the firm's inspection is elaborated beyond that laid down by the government authorities only to the extent found in practice to be necessary.

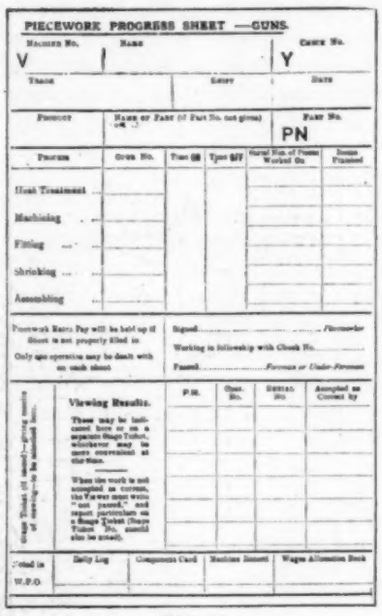
It is not therefore considered essential to indicate precisely the extent to which the firm's inspection routine is supplementary to that called for by the government.

The works inspector is responsible directly to the general manager, but acts in collaboration with the works manager, who is responsible to the general manager for production. This division of responsibilities is arranged with a view to insuring independent criticism of the work at every stage in production. The relation between the two, in the words of the general manager, should be that of "armed neutrality."

The inspection department will not accept responsibility for giving instructions as to technical processes; its function is to see that the specified instructions are properly carried out. It follows therefore that in the early stages, immediately after a forging has been made, instructions as to heat treatment have to be issued by the works manager in accordance with the particulars of chemical analysis received from the steel makers. At other stages instructions have to be issued by the works manager for shrinkages based on the data of previous operations. This reference illustrates points at which the inspection department looks to the works manager to issue what may be said to be an individual specification for the component under consideration. The other points of collaboration that this practice involves will be gathered on consideration of the several inspection stages referred to later.

Coördination of the works management, the inspection department and the shop foremen in all matters calling for the exercise of considered and conjoint judgment are achieved by means of a gun committee, which meets every morning and deals with certain issues of production that have been found necessary to discuss. The members of this committee are the works manager and works inspector and their respective assistants, and the gun-shop foreman. The general manager presides as often as practicable. Notes are taken by a stenographer and minutes are distributed daily to each member of the committee. The business of the committee necessarily varies, but the measurement of collapsing after wiring and contraction after shrinking are dealt with for each gun. This, in fact, is the outstanding function of the committee, because of the vital relationship of these matters to the results of firing proof.

The form of report used by the inspection depart-



PIECEWORK PROGRESS SHEET —GUNS.

Machine No. V | Name | Check No. Y

Trade | Letter | Date

Foreman | Name or Part (if Part No. not given) | Part No. PN

Process | Gross No. | Time (H) | Type (F) | Normal Nos. of Pieces Worked On | Bonus Planned

Heat Treatment ...
Machining ...
Fitting ...
Shrinking ...
Assembling ...

Piecework Rates Pay will be held up if Sheet is not properly filled in
Only one operation may be dealt with on each sheet

Signed ..... Foreman

Working in fellowship with Check No. .....

Passed ..... Foreman or Under-Foreman

Viewing Results.

These may be indicated here or on a separate Stage Ticket, whichever may be more convenient at the time.

When the work is not accepted as correct, the Viewer must write "not passed," and report particulars on a Stage Ticket (Stage Ticket No. should also be stated).

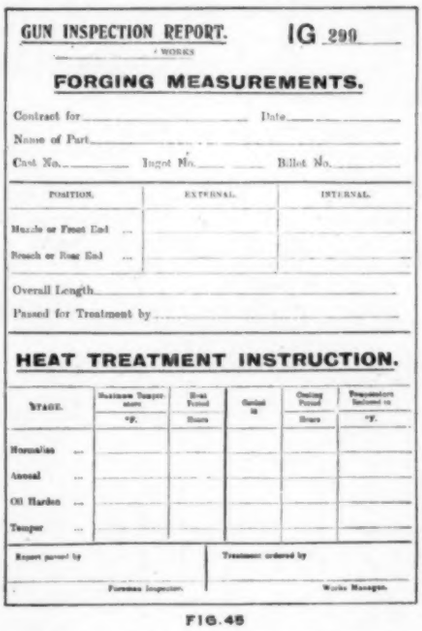
P.N. | Oper. No. | Serial No. | Accepted as Correct by

Stage Ticket (if issued)—giving results of viewing—to be attached here.

Noted in | Daily Log | Component Card | Machine Record | Wages Allocation Book

W.P.O.

FIG. 44



GUN INSPECTION REPORT. IG 299

WORKS

FORGING MEASUREMENTS.

Contract for ..... Date .....

Name of Part .....

Cast No. ..... Ingot No. ..... Billet No. .....

POSITION.	EXTERNAL.	INTERNAL.
Muzzle or Front End ...		
Breech or Rear End ...		

Overall Length .....

Passed for Treatment by .....

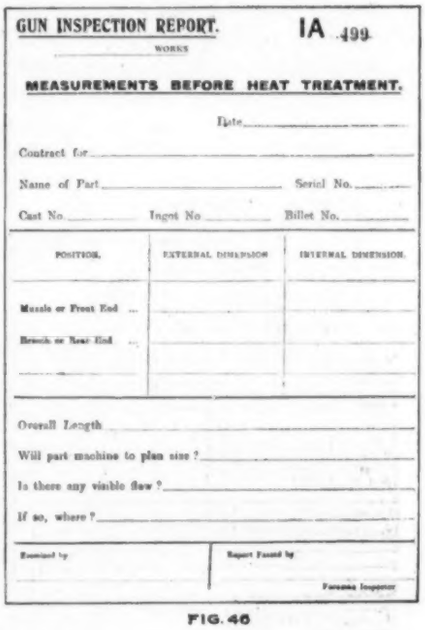
HEAT TREATMENT INSTRUCTION.

STAGE.	Maximum Temperature	Heat Period	Cooled in	Cooling Period	Temperature finished at
	°F.	Hours		Hours	°F.
Normalize ...					
Anneal ...					
Oil Harden ...					
Temper ...					

Report passed by ..... Foreman Inspector.

Treatment ordered by ..... Works Manager.

FIG. 45



GUN INSPECTION REPORT. IA 499

WORKS

MEASUREMENTS BEFORE HEAT TREATMENT.

Date .....

Contract for .....

Name of Part ..... Serial No. .....

Cast No. ..... Ingot No. ..... Billet No. .....

POSITION.	EXTERNAL DIMENSION.	INTERNAL DIMENSION.
Muzzle or Front End ...		
Breech or Rear End ...		

Overall Length .....

Will part machine to plan size? .....

Is there any visible flaw? .....

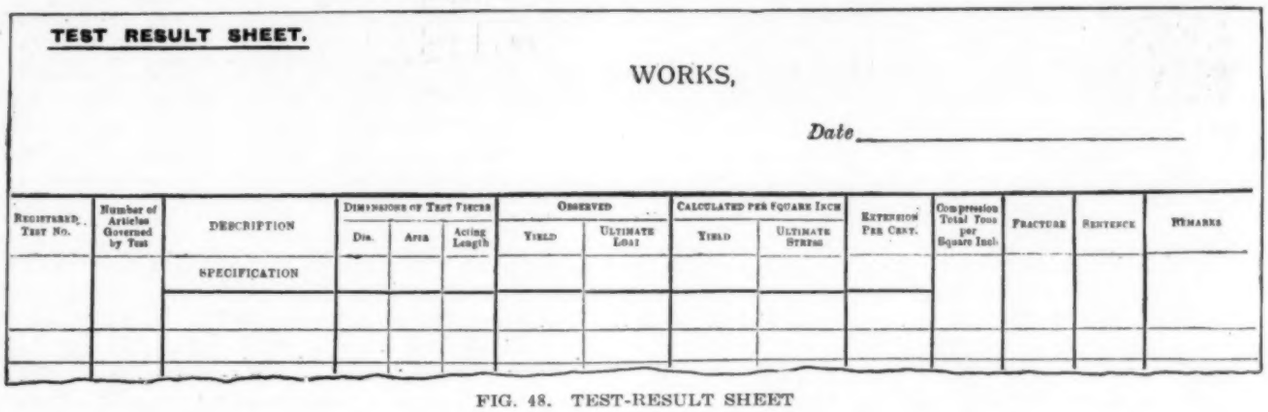
If so, where? .....

Examined by ..... Report Passed by ..... Foreman Inspector.

FIG. 46

FIGS. 44 TO 46. SOME OF THE REPORT SHEETS USED

Fig. 44—Piecework progress sheet. Fig. 45—IG forging measurements. Fig. 46—IA measurements before heat treatment



TEST RESULT SHEET.

WORKS,

Date .....

Registered Test No.	Number of Articles Governed by Test	DESCRIPTION	Dimensions of Test Pieces: Dia.	Area	Acting Length	Observed: Yield	Observed: Ultimate Load	Calculated per Square Inch: Yield	Calculated per Square Inch: Ultimate Stress	Extension Per Cent.	Compression Total Tons per Square Inch	Fracture	Sentence	Remarks
		SPECIFICATION												

FIG. 48. TEST-RESULT SHEET

its function is to see that the specified instructions are properly carried out. It follows therefore that in the early stages, immediately after a forging has been made, instructions as to heat treatment have to be issued by the works manager in accordance with the particulars of chemical analysis received from the steel makers. At other stages instructions have to be issued by the works manager for shrinkages based on the data of previous operations. This reference illustrates points at which the inspection department looks

The form of report used by the inspection depart-

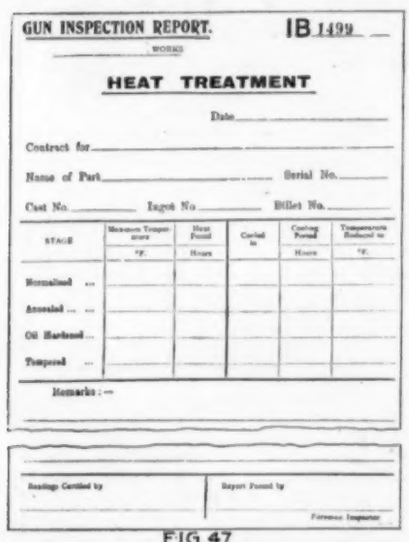
ment varies according to the stage of process to be dealt with. But while the reports differ in form the difference is one rather of convenience than of principle. Each report sets out the data requisite to a knowledge of what occurred, or the condition of the component, at that particular stage.

It may be of interest to refer to the method used by the inspection department for certifying the operations completed by the workman. Each operator fills up either a day-work or a piecework progress sheet, the latter being illustrated in Fig. 44. This explains itself, but it should be stated that payment for piecework is made only on the certificate of an examiner or a viewer belonging to the inspection department. The viewer is provided with a metal stamp bearing a number, which has to be impressed on the document to give it authority. This course is taken to obviate the risks of initials being imitated by unauthorized persons. When the viewer finds that the work is not strictly to plan, that is to say, not within the dimensions and tolerances laid down, he does not condemn the work, but refers the matter to the chief inspector, who decides as to the advisability of further work and the payment of the operator.

In connection with the process of heat treatment certain inspection requirements follow from the necessity of providing a test immediately after heat treatment has been carried out.

When a forging is made at the works or is received from outside without having been heat-treated the routine adopted is at once to stencil the forging in white paint "Not Passed Test." Forging measurements are then taken on gun-inspection report IG, Fig. 45. This serves to record the dimensions of the forging before it is rough-machined in preparation for heat treatment. After the forging has been rough-machined a second gun-inspection report, IA, Fig. 46, is made out. At both stages the forging is scrutinized for flaws, and the first set of measurements are checked to see that sufficient machining allowances have been provided.

These reports are made out by the heat-treatment viewer under the instruction of the works inspector and passed to the works manager. With the dimensions evident on the second report the works manager can satisfy himself as to the amount of material left for cutting-off disks from which test pieces can be prepared. The works manager, with the particulars of chemical


GUN INSPECTION REPORT. IB 1499

HEAT TREATMENT

Date

Contract for

Name of Part Serial No.

Cast No. Ingot No. Billet No.

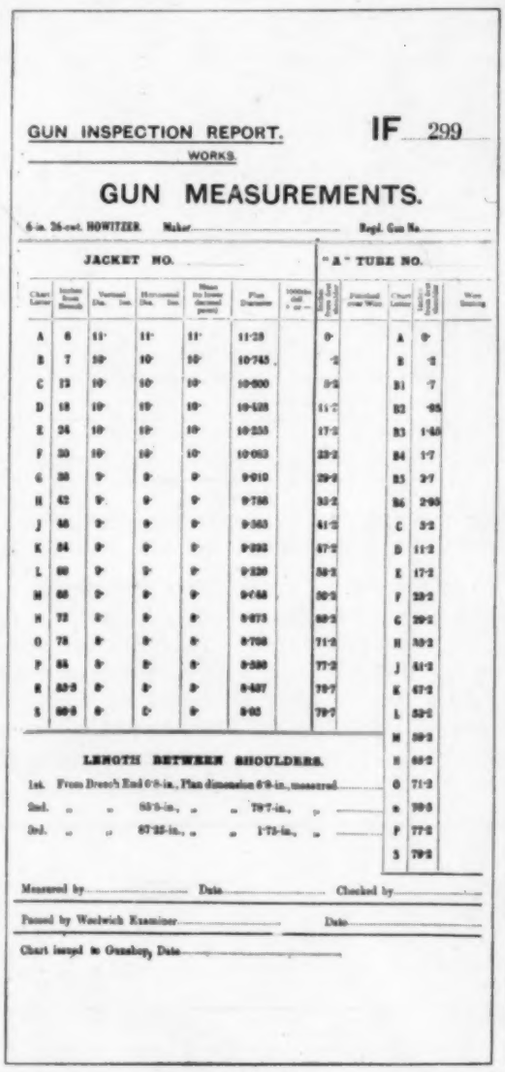
STAGE	Maximum Temperature °F.	Heat Period Hours	Cooled to	Cooling Period Hours	Temperature Reduced to °F.
Normalized					
Annealed					
Oil Hardened					
Tempered					

Remarks:—

Readings Certified by | Report Passed by

Foreman Inspector

FIG. 47


GUN INSPECTION REPORT. IF 299

WORKS.

GUN MEASUREMENTS.

6-in. 26-cwt. HOWITZER. Maker Regd. Gun No.

JACKET NO. "A" TUBE NO.

Chart Letter	Inches from Muzzle End	Vertical Dia. Ins.	Horizontal Dia. Ins.	Mean (to lower decimal point)	Plan Dimension	1000ths Gill = 0·—	Finished over Wire	Chart Letter	Inches from Muzzle End	Wire Gauging
A	6	11·	11·	11·25	0·			A	0·	
B	7	10·	10·	10·745	·2			B	·2	
C	13	10·	10·	10·600	0·2			B1	·7	
D	18	10·	10·	10·428	11·2			B2	·95	
E	24	10·	10·	10·255	17·2			B3	1·45	
F	30	10·	10·	10·083	23·2			B4	1·7	
G	36	9·	9·	9·910	29·2			B5	2·7	
H	42	9·	9·	9·738	35·2			B6	2·95	
J	48	9·	9·	9·565	41·2			C	3·2	
K	54	9·	9·	9·393	47·2			D	11·2	
L	60	9·	9·	9·220	53·2			E	17·2	
M	66	9·	9·	9·048	59·2			F	23·2	
N	72	9·	9·	8·875	65·2			G	29·2	
O	78	8·	8·	8·703	71·2			H	35·2	
P	84	8·	8·	8·530	77·2			J	41·2	
R	89·5	8·	8·	8·407	79·7			K	47·2	
S	90·5	8·	8·	8·03	79·7			L	53·2	
								M	59·2	
								N	65·2	
								O	71·2	
								R	79·5	
								P	77·2	
								S	79·2	

LENGTH BETWEEN SHOULDERS.

1st. From Breech End 6·0 in., Plan dimension 6·0 in., measured .....

2nd. " " 83·5-in., " " 79·7-in., " .....

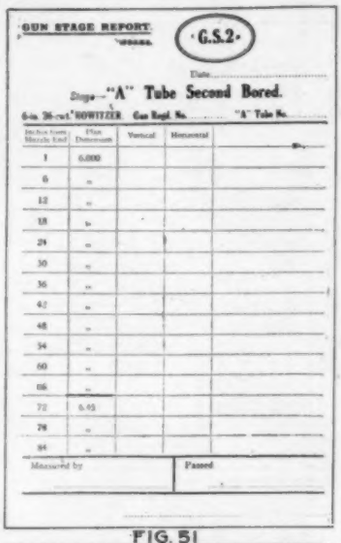
3rd. " " 87·25-in., " " 1·73-in., " .....

Measured by Date Checked by

Passed by Woolwich Examiner Date

Chart issued to Gunshop, Date

FIG. 50


GUN STAGE REPORT. G.S.2

Date

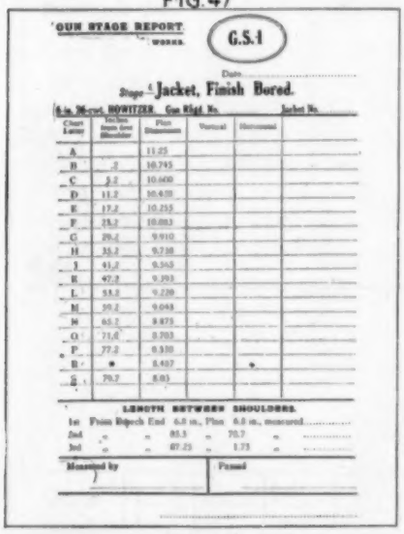
Stage—"A" Tube Second Bored.

6-in. 26-cwt. HOWITZER. Gun Regd. No. "A" Tube No.

Inches from Muzzle End	Plan Dimension	Vertical	Horizontal	
1	6.000			
6	"			
12	"			
18	"			
24	"			
30	"			
36	"			
42	"			
48	"			
54	"			
60	"			
66	"			
72	6.45			
78	"			
84	"			

Measured by Passed

FIG. 51


GUN STAGE REPORT. G.S.1

Date

Stage—Jacket, Finish Bored.

6-in. 26-cwt. HOWITZER. Gun Regd. No. Jacket No.

Chart Letter	Inches from Muzzle End	Plan Dimension	Vertical	Horizontal	
A		11.25			
B	·2	10.745			
C	3·2	10.600			
D	11·2	10.428			
E	17·2	10.255			
F	23·2	10.083			
G	29·2	9.910			
H	35·2	9.738			
J	41·2	9.565			
K	47·2	9.393			
L	53·2	9.220			
M	59·2	9.048			
N	65·2	8.875			
O	71·2	8.703			
P	77·2	8.530			
R	•	8.407		•	
S	79·2	8.03			

LENGTH BETWEEN SHOULDERS.

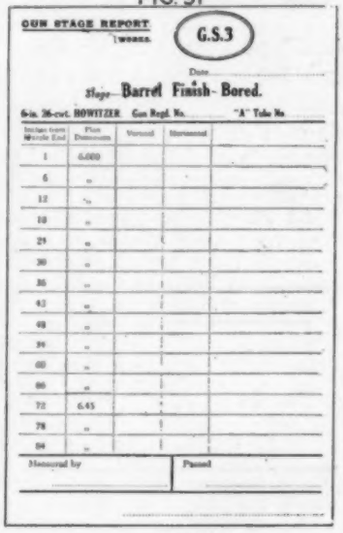
1st From Breech End 6.0 in., Plan 6.0 in., measured .....

2nd " " 83.5 " 79.7 " .....

3rd " " 87.25 " 1.73 " .....

Measured by Passed

FIG. 49


GUN STAGE REPORT. G.S.3

Date

Stage—Barrel Finish-Bored.

6-in. 26-cwt. HOWITZER. Gun Regd. No. "A" Tube No.

Inches from Muzzle End	Plan Dimension	Vertical	Horizontal	
1	6.000			
6	"			
12	"			
18	"			
24	"			
30	"			
36	"			
42	"			
48	"			
54	"			
60	"			
66	"			
72	6.45			
78	"			
84	"			

Measured by Passed

FIG. 52

FIGS. 47, 49, 50, 51 AND 52. HEAT-TREATING AND BORING REPORTS

Fig. 47—IB heat treatment. Fig. 49—G.S.-1 jacket, finish-bored. Fig. 50—IF gun measurements. Fig. 51—G.S.-2 A-tube second-bored. Fig. 52—G.S.-3 barrel finish-bored

analysis of the steel in question before him, is able to fill in the heat-treatment instructions on the lower part of the form, Fig. 45. This instruction goes out to the heat-treatment foreman. The heat-treatment viewer is also advised and checks the temperatures used. He then issues a third gun-inspection report, IB, Fig. 47, recording the heat treatment. These three reports provide the basis for reheating instructions should the results of test in the first instance prove unsatisfactory.

The test pieces are prepared in duplicate. One set is passed to the government inspector and the official sentence is based on the results he obtains; the other set is used for the firm's own guidance, so as to enable it to learn the results of heat treatment without waiting for the government inspector. If the firm's tests are satisfactory the forging is laid aside to await the official sentence. When this is favorable the government inspector stamps the forging as passed, and the works inspector then stencils the forging in red, "Passed Test," obliterating the original stenciling. This procedure is very necessary to eliminate the risks of forgings being moved into the machine shop and machined before being officially passed. If the firm's tests are unsatisfactory, retreatment is put in hand accordingly. The form used for reporting the test result is shown in Fig. 48. The appearance of the fracture of the test piece is a valuable guide to the character of heat treatment required.

A useful point may be made here as to the importance attaching to the previous transfer of government stamps and official marking during the process of machining. Workmen are very apt to machine out these official markings before getting their foreman to call in the government examiner to transfer the marks. The process of transfer is of course to repeat the stampings and official markings on such portion of the surface as will entail the least amount of further transfer as the machining proceeds toward completion.

It will be noticed that on the gun-inspection reports illustrated, provision is made for the cast number, ingot number and billet number. These particulars are supplied by the steel maker, and when the forging is made a serial number is adopted, which serves as a code for this triple identification reference, and thus saves multiplicity of stamping and facilitates reference.

The firm has established what is called a work depot under the administration and part of the inspection department. This depot is distinct from any of the manufacturing departments. It is the center from which the handling of the material and components is actually regulated. It is also the depository for work in progress not required at the moment in the shops and for finished components which are in due course issued in sets for assembling. Assembled guns are sent to the work depot and from there sent to the proving range. In the relation of the work depot to the manufacturing departments the principle upon which the regulation of movement is founded is that the component at certain specified stages either actually passes into the work depot or does so by proxy, a delivery note being used to that end, the main rule being that all finished components must go to the work depot before being issued for assembling. The work depot, of course, is staffed with examiners who check all measurements of finished work under conditions rather more favorable than checking alongside the machine in the shop. The delivery-note system too between work depot and the manufacturing departments enables the depot to maintain a proper record of the progress on each component.

At least once a week a general-manager's instruction sheet (not reproduced) is issued to all departments concerned, giving the official results of test to insure that no component is finish-machined unless it has been

GUN STAGE REPORT. G.S.4

WORKS.

Date.....

Stage—Barrel Lapped before Wiring.

6-in. 26-cwt. HOWITZER. Gun Regd. No..... "A" Tube No.....

Inches from Muzzle End	Plan Dimension	Vertical	Horizontal	
1	6.000			
6	"			
12	"			
18	"			
24	"			
30	"			
36	"			
42	"			
48	"			
54	"			
60	"			
66	"			
72	6.43			
78	"			
84	"			

Measured by ..... Passed .....

FIG. 53

GUN STAGE REPORT. G.S.5

WORKS.

Date.....

Stage—Finish Turned "A" Tube before Wiring (TO CHART).

6-in. 26-cwt. HOWITZER. Gun Regd. No..... "A" Tube No.....

Chart Letter	Inches from First Shoulder	Chart Dimension	Vertical	Horizontal	
B	.2				
B1	.7				
B2	.95				
B3	1.45				
B4	1.7				
B5	2.7				
B6	2.95				
C	5.2				
D	11.2				
E	17.2				
F	23.2				
G	29.2				
H	35.2				
J	41.2				
K	47.2				
L	53.2				
M	59.2				
N	65.2				
O	71.2				
●	76.5				
P	77.2				
R	77.7				

Measured by ..... Passed .....

FIG. 54

GUN STAGE REPORT. G.S.6

WORKS.

Date.....

Stage—"A" Tube Wired (to Chart)

6-in. 26-cwt. HOWITZER. Gun Regd. No..... "A" Tube No.....

Chart Letter	Inches from First Shoulder	Chart Dimension	Vertical	Horizontal	Machining Allowance	
A						
B	.2					
C	5.2					
D	11.2					
E	17.2					
F	23.2					
G	29.2					
H	35.2					
J	41.2					
K	47.2					
L	53.2					
M	59.2					
N	65.2					
O	71.2					
P	77.2					
R	78.7					
S	79.7					

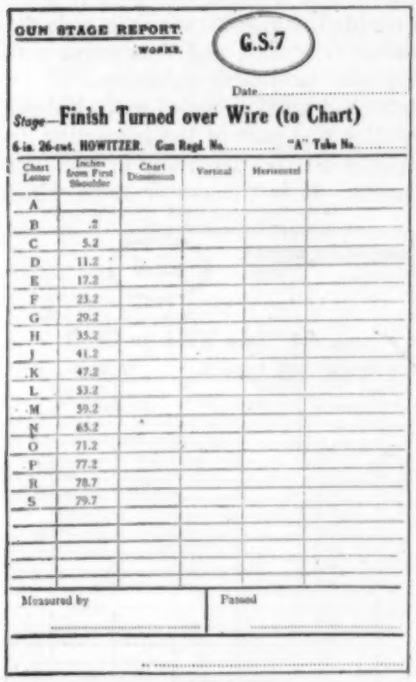
Measured by ..... Passed .....

FIG. 55

FIGS. 53 TO 55. LAPPING, TURNING AND WIRING REPORTS

Fig. 53—G.S.-4 Barrel lapped before wiring. Fig. 54—G.S.-5 finish-turned A-tube before wiring. Fig. 55—G.S.-6 A-tube wired (to chart)

accepted by the government inspector. The shop is informed by delivery note that machining may proceed. Care is taken that all government stamps and official markings are transferred, a note being sent to the government inspector when ready for the transfer. Passed taken by a rock-over gage. In fact, generally internal measurements are taken with rock-over plate gages (verniers) and external diameters with micrometers, and for standard measurements the usual form and limit gages are issued from the tool stores, being


GUN STAGE REPORT. G.S.7

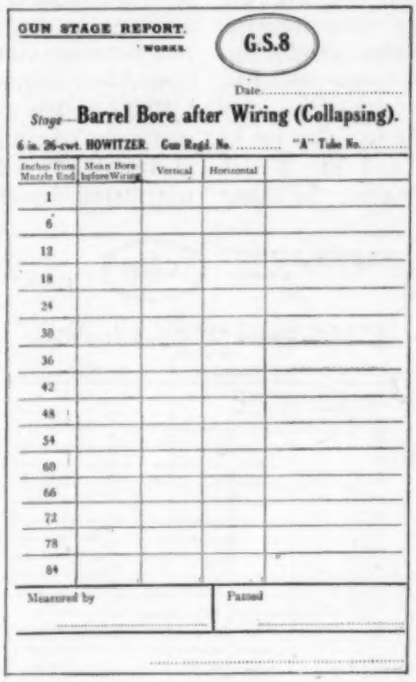
Stage—Finish Turned over Wire (to Chart)

6 in. 26-cwt. HOWITZER. Gun Regd. No. ..... "A" Tube No. .....

Chart Letter	Inches from First Shoulder	Chart Dimension	Vertical	Horizontal	
A					
B	.2				
C	5.2				
D	11.2				
E	17.2				
F	23.2				
G	29.2				
H	35.2				
J	41.2				
K	47.2				
L	53.2				
M	59.2				
N	65.2				
O	71.2				
P	77.2				
R	78.7				
S	79.7				

Measured by ..... Passed .....

FIG. 56


GUN STAGE REPORT. G.S.8

Date.....

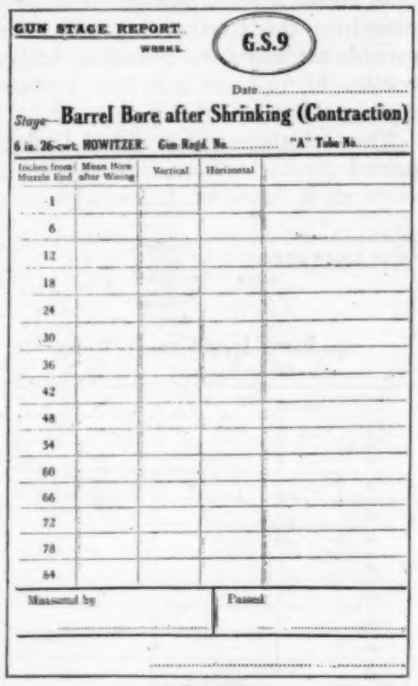
Stage—Barrel Bore after Wiring (Collapsing).

6 in. 26-cwt. HOWITZER. Gun Regd. No. ..... "A" Tube No. .....

Inches from Muzzle End	Mean Bore before Wiring	Vertical	Horizontal	
1				
6				
12				
18				
24				
30				
36				
42				
48				
54				
60				
66				
72				
78				
84				

Measured by ..... Passed .....

FIG. 57


GUN STAGE REPORT. G.S.9

Date.....

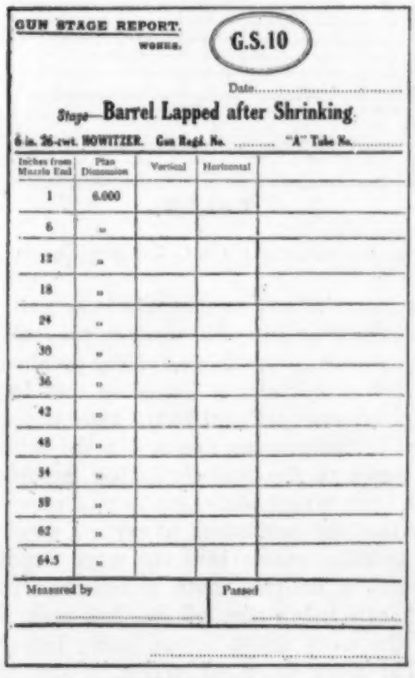
Stage—Barrel Bore after Shrinking (Contraction)

6 in. 26-cwt. HOWITZER. Gun Regd. No. ..... "A" Tube No. .....

Inches from Muzzle End	Mean Bore after Wiring	Vertical	Horizontal	
1				
6				
12				
18				
24				
30				
36				
42				
48				
54				
60				
66				
72				
78				
84				

Measured by ..... Passed .....

FIG. 58


GUN STAGE REPORT. G.S.10

Date.....

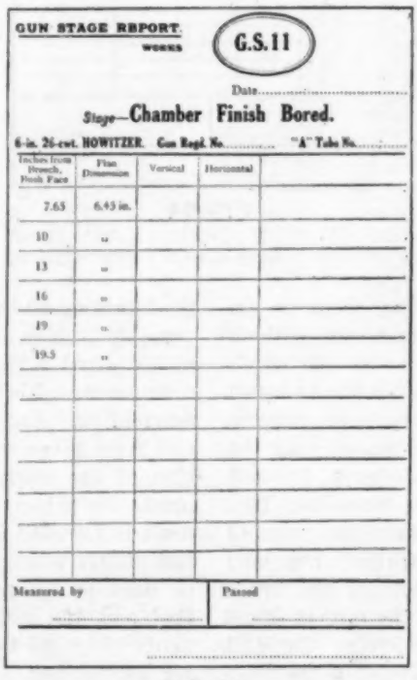
Stage—Barrel Lapped after Shrinking

6 in. 26-cwt. HOWITZER. Gun Regd. No. ..... "A" Tube No. .....

Inches from Muzzle End	Plan Dimension	Vertical	Horizontal	
1	6.000			
6	"			
12	"			
18	"			
24	"			
30	"			
36	"			
42	"			
48	"			
54	"			
58	"			
62	"			
64.5	"			

Measured by ..... Passed .....

FIG. 59


GUN STAGE REPORT. G.S.11

Date.....

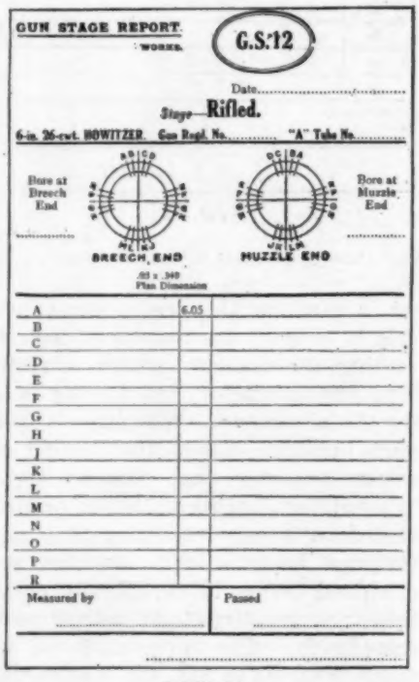
Stage—Chamber Finish Bored.

6 in. 26-cwt. HOWITZER. Gun Regd. No. ..... "A" Tube No. .....

Inches from Breech, Fresh Face	Plan Dimension	Vertical	Horizontal	
7.65	6.45 in.			
10	"			
13	"			
16	"			
19	"			
19.5	"			

Measured by ..... Passed .....

FIG. 60


GUN STAGE REPORT. G.S.12

Date.....

Stage—Rifled.

6 in. 26-cwt. HOWITZER. Gun Regd. No. ..... "A" Tube No. .....

Bore at Breech End ..... Bore at Muzzle End .....

A	6.05		
B			
C			
D			
E			
F			
G			
H			
J			
K			
L			
M			
N			
O			
P			
R			

Measured by ..... Passed .....

FIG. 61

FIGS. 56 TO 61. VARIOUS GUN STAGE REPORT SHEETS

Fig. 56—G.S.-7 finish-turned over wire. Fig. 57—G.S.-8 barrel bore after wiring (collapsing). Fig. 58—G.S.-9 barrel bore after shrinking (contraction). Fig. 59—G.S.-10 barrel lapped after shrinking. Fig. 60—G.S.-11 chamber finish-bored. Fig. 61—G.S.-12 rifled

forgings are issued to the machine shop when required from the work depot, this being kept balanced by the forgings required being heat-treated in advance of the machine requirements, the depot serving as an overflow for forgings as well as for machined components.

When the jacket is finish-bored, the dimensions are checked before issue. The measurements are recorded by the shop examiner on a gun-stage report, Form G.S.-1, Fig. 49, and the figures applied by the works inspector are shown on inspection report, Form I.F., Fig. 50. The dimensions here given allow for collapsing after wiring, machining wire and shrinking

From this the chart already shown in Fig. 10 is prepared for shop use, giving actual dimensions to which the A-tube must be finished. This chart is sent to the shop in duplicate, one in black for the turner, and one in red by which the examiners check the work.

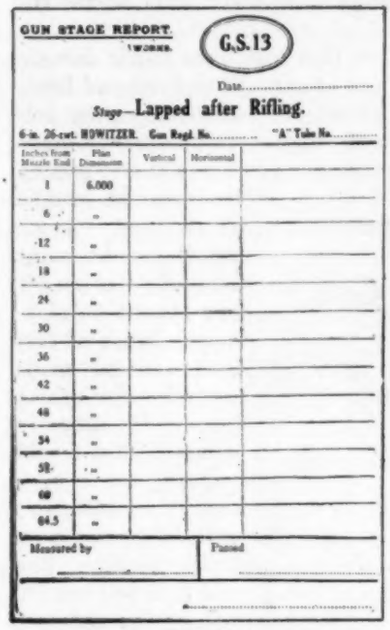
The A-tube is measured and checked during the progress of operations by examiners who use Forms G.S.-2 to G.S.-8, Fig. 51 to 57. At the stages shown by G.S.-2 to G.S.-4 the A-tube is bored and rough-turned; at G.S.-5 it is turned to chart; at G.S.-6 to G.S.-8 it is wired and turned. The over-wire dimensions of the tube are checked with the bore of the jacket by the works manager and chief inspector at intermediate points in addition to those recorded on the above-mentioned forms. The dimensions are considered in conjunction with the information supplied on Form G.S.-8, Fig. 57, and the works manager decides whether the tube is in order for shrinking on the jacket or not. After the shrinking the gun is again inspected and the bore measured, Form G.S.-9, Fig. 58, being used to record the contraction due to shrinkage by comparing the same with the dimensions recorded on G.S.-8.

Final Stages

The gun, if passed on this inspection, is now released for the final stages of machining, including rifling. The various stages are inspected and the dimensions recorded by the inspectors on Forms G.S.-10 to G.S.-14, Figs. 59 to 63. When complete the gun is returned to a work or assembling depot for final inspection, gutta-percha impressions being taken of the rifling, the body gage tried to insure the alignment of the howitzer and carriage, and a bore plug gage 5.994 in. in diameter to test for straightness of bore.

The results of the firm's final inspection are recorded on the form shown in IC, Fig. 64. If accepted by the government inspector the gun is ready for dispatch to proof, and the dispatch department is informed by this inspection certificate being delivered to that office. This procedure is carried out to prevent guns being sent to proof without proper authority. If, however, the gun is rejected it is returned to the machine shop for rectification, the inspection certificate going to the works manager to give particulars of defects.

All components are dealt with as thoroughly as their nature requires, and on completion of machining they are lodged with the works depot for final inspection and reissue for building or assembling purposes. If any gun is rejected at proof it is returned to the works and dealt with as a repair gun by relining, that is, by fitting a new A-tube. This contingency is not likely to arise often under normal conditions. Finally, the information obtained through the various forms described is tabulated for each gun and filed for reference.


GUN STAGE REPORT. G.S.13

Works

Date.....

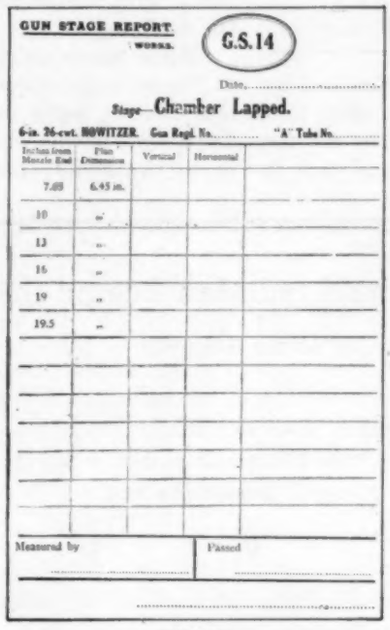
Stage—Lapped after Rifling.

6-in. 26-cwt. HOWITZER. Gun Regd. No..... "A" Tube No.....

Inches from Muzzle End	Plan Dimension	Vertical	Horizontal	
1	6.000			
6	"			
12	"			
18	"			
24	"			
30	"			
36	"			
42	"			
48	"			
54	"			
58	"			
60	"			
64.5	"			

Measured by | Passed

FIG. 62


GUN STAGE REPORT. G.S.14

Works

Date.....

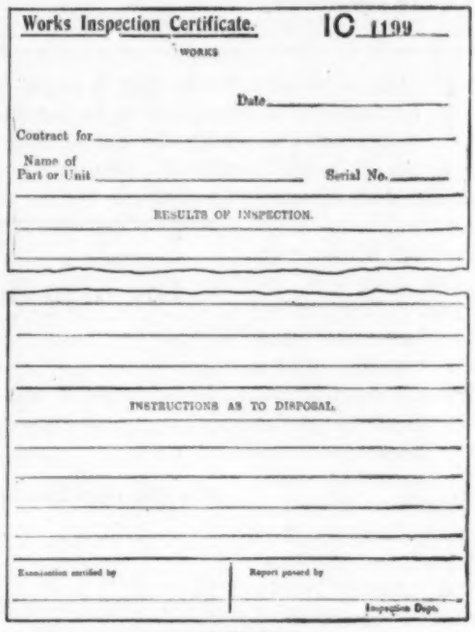
Stage—Chamber Lapped.

6-in. 26-cwt. HOWITZER. Gun Regd. No..... "A" Tube No.....

Inches from Muzzle End	Plan Dimension	Vertical	Horizontal	
7.69	6.45 in.			
10	"			
13	"			
16	"			
19	"			
19.5	"			

Measured by | Passed

FIG. 63


Works Inspection Certificate. IC 1199

WORKS

Date.....

Contract for.....

Name of Part or Unit..... Serial No.....

RESULTS OF INSPECTION.

INSTRUCTIONS AS TO DISPOSAL.

Examination certified by | Report passed by

Inspection Dept.

FIG. 64

FIGS. 62 TO 64. REPORTS AND INSPECTION CERTIFICATE—FINAL STAGES

Fig. 62—G.S.-13 lapped after rifling. Fig. 63—G.S.-14 chamber lapped. Fig. 64—IC—Works inspection certificate

Raising the "Visibility" of the Oil Holes in Shadowed Positions

By M. S. Herbert

Director of the Holyoke Vocational Schools

Having derived a great deal of benefit from the ideas of other men and shops as published in the *American Machinist* I feel under obligation to pass on a simple little kink in the hope that it may be of service to others.

In overhauling the machines and shafting in our shop this summer Charles E. Dawson, the shop head, discovered that some oil holes were in shadowed positions somewhat difficult to see and were consequently liable to be overlooked. He has painted a white ring around every oil hole on every bearing in the shop and we believe the time taken in so marking these spots to have been well spent.

Oil holes that were formerly rather difficult to locate now show up plainly, a feature that makes them more apt to receive the proper attention.

Opportunities for Returning Soldiers

SPECIAL CORRESPONDENCE

The equitable and generous treatment of our returning soldiers is a great problem which we must begin to consider now. Secretary Lane points out a practical plan which should be carefully considered.

THE following extracts from a paper submitted by Secretary Franklin K. Lane to the President contain much that can well be considered by all, for although it speaks mostly of men going on farms it means that we cannot count on large numbers of our men going back into the shop: "I believe the time has come when we should give thought to the preparation of plans for providing opportunity for our soldiers returning from the war. Because this department has handled similar problems I consider it my duty to bring this matter to the attention of yourself and Congress. Every country has found itself face to face with this situation at the close of a great war. From Rome under Cæsar to France under Napoleon and down even to our own Civil War the problem arose as to what could be done with the soldiers to be mustered out of military service. The great part the veterans of that war played in developing the West is one of our epics. The homestead law had been signed by Lincoln in the second year of the war, so that out of our wealth in lands we had farms to offer the million of veterans. It was also the era of transcontinental railway construction. It was likewise the period of rapid, yet broad and full, development of towns and communities and states.

"To the great number of returning soldiers land will offer the great and fundamental opportunity. The experience of wars points out the lesson that our service men, because of army life with its openness and activity, will largely seek out-of-door vocations and occupations. This fact is accepted by the allied European nations. That is why their programs and policies of relocating and readjustment emphasize the opportunities on the land for the returning soldier. The question then is 'What land can be made available for farm homes for our soldiers?'

"While we do not have that matchless public domain of '65, we do have millions of acres of undeveloped lands that can be made available for our homecoming soldiers. We have arid lands in the West; cut-over lands in the Northwest, lake states and South, and also swamp lands in the Middle West and South which can be made available through the proper development. Much of this land can be made suitable for farm homes if properly handled. But it will require that each kind of land be dealt with in its own particular fashion. The arid land will require water; the cut-over land will require clearing, and the swamp land must be drained. The solution of these problems is no new thing. In the admirable achievement of the Reclamation Service in reclamation and drainage we have abundant proof of what can be done. A survey and study has been in the course of consummation by the Reclamation Service on the great Colorado basin. That great project, I believe, will appeal to the new spirit of America. It would mean the conquest of an empire in the Southwest. It is believed that more than three millions of acres of arid land could be reclaimed by the completion of the upper and lower Colorado basin projects.

"It has been officially estimated that more than fifteen millions of acres of irrigable land now remain in the Government's hands. This is the great remaining storehouse of Government land for reclamation. Under what policy and program millions of these acres could be reclaimed for future farms and homes remains for legislation to determine. The amount of swamp and

The Man Behind the Man Behind the Gun

By MARIE RANDALL

I can't fight in the trenches 'cause my hair is gettin' gray,
And they say my days of work are nearly done;
But there's one thing that I'm proud of, and I say it every day,
I'm the man behind the man behind the gun.

□ □ □

Sometimes I'm feelin' mournful-like because I'm gettin' old
And younger lads are havin' all the fun;
But I keep a-working steady for I want to have it told
I'm the man behind the man behind the gun.

□ □ □

When trouble starts a-coming in the front line over there;
When our lads are gettin' hustled by the Hun;
We want 'em to be mighty sure the game is on the square
With the man behind the man behind the gun.

□ □ □

The boys will win the victory and make us mighty glad—
Sure, and one of them may be my only son.
I want him to come back and say "You helped us do it, dad;
You're the man behind the man behind the gun."

cut-over lands in the United States that can be made available for farming is extensive. Practically all of it has passed into private ownership. For that reason, in considering its use, it would be necessary to work out a policy between the private owners and the Government unless the land was purchased.

"Any plan for the development of land for the returning soldier will come face to face with the fact that a new policy will have to meet the new conditions. The era of free or cheap land in the United States has passed. We must meet the new conditions of developing lands in advance—security must to a degree displace speculation.

"There are certain tendencies which we ought to face frankly in our consideration of a policy for land to the homecoming soldier. First, the drift to farm tenancy. The experience of the world shows without question that the happiest people, the best farms and the soundest political conditions are found where the farmer owns the home and the farm lands. The growth of tenancy in America shows an increase of 32 per cent. for the 20 years between 1890 and 1910. Second, the drift to urban life. In 1880 of the total population of the United States 29.5 per cent. of our people resided in cities, and 70.5 per cent. in the country. At the census of 1910, 46.3 per cent. resided in cities and 53.7 per cent. remained in the country. It is evident that since the war in Europe there has been a decided increase in the trend toward the city because of industrial conditions. The adoption by the United States of new policies in its land-development plans for returning veterans will also contribute to the amelioration of these two dangers to American life.

"A plan of land development whereby land is developed in large areas, subdivided into individual farms, then sold to actual bona-fide farmers on a long-time-payment basis, has been in force not only in the United States under the Reclamation Act, but also in many other countries for several years. It has proved a distinct success. In Denmark, Ireland, New Zealand and Australia it has completely changed the land situation. One of the new features of this plan is that holders are aided in improving and cultivating the farm. In a word, there is organized community development.

How It Works in New Zealand

"Its beneficial results have been well described by the Canadian Commission which was appointed to investigate its results in New Zealand in these words: '. . . The farmers have built better houses or remodeled their old ones, brought a larger acreage of land under cultivation that would otherwise be lying idle; have bought and kept better livestock; have bought and urged more labor-saving machinery on the farms and in the houses. . . . They keep more sheep and pigs and have so largely increased the revenue from their farms that they are able to meet the payments on the mortgages and to adopt a higher standard of living and a better one. Throughout the country a higher and better civilization is gradually being evolved; the young men and women who are growing up are happy and contented to remain at home on the farm and find ample time and opportunity for recreation and entertainment of a kind more wholesome and elevating than can be obtained in the cities.'

"It may be said that this country, outside of Alaska, has no frontier today. Of course, Alaska will still offer opportunity for a pioneer life. And of course Alaska likewise has yet unknown remarkable agricultural possibilities, but unless we make possible the development of this land by the men who desire their life in that field we will lose a great national opportunity.

"This is an immediate duty. It will be too late to plan for these things when the war is over. Our thought now should be given to the problem. And I therefore desire to bring to your mind the wisdom of immediately supplying the Interior Department with a sufficient fund with which to make the necessary surveys and studies. We should know by the time the war ends not merely how much arid land can be irrigated, or how much swamp land reclaimed, or where the grazing land is and how many cattle it will support, or how much cut-over land can be cleared, but we should know with definiteness where it is practicable to begin new irrigation projects, what the character of the land is, what the nature of the improvements needed will be and what the cost will be. We should know also what areas of swamp land may be reclaimed, how they can be drained, what the cost of the drainage will be, what crops they will raise. We should have in mind specific areas of grazing lands, with a knowledge of the cattle that is best adapted to them, and the practicability of supporting a family upon them. So too with our cut-over lands. We should know what it would cost to pull or 'blow-out' stumps and to put the lands into condition for a farm home.

Buying the Land if Necessary

"And all this should be done upon a definite planning basis. We should know what it will cost to buy these lands if they are in private hands. At the conclusion of the war the United States should be able to say to its returned soldiers: 'If you wish to go on a farm, here are a variety of farms of which you may take your pick, which the Government has prepared against the time of your returning.' A very small sum of money put into the hands of men of thought, experience and vision will give us a program which will make us feel entirely confident that we are not to be submerged industrially or otherwise by labor which we will not be able to absorb, or that we would be in a condition where we would show a lack of respect for those who return as heroes, but who will be without means of immediate self-support. A million or two dollars if appropriated now will put this work well under way.

"This plan does not contemplate anything like charity to the soldier. He is not to be given a bounty. He is not to be made to feel that he is a dependent. On the contrary, he is to continue in a sense in the service of the Government. Instead of destroying our enemies he is to develop our resources.

"The work that is to be done other than the planning should be done by the soldier himself. The dam or the irrigation project should be built by him; the canals, the ditches, the breaking of the land and the building of the houses should, under proper direction, be his occupation. He should be allowed to make his own home, cared for while he is doing it and given an interest in the land for which he can pay through a long period of years, perhaps 30 or 40 years. This same policy can be carried

out as to the other kinds of land, so that the soldier on his return would have an opportunity to make a home for himself, to build a home with money which we would advance and which he would repay, and for the repayment we would have abundant security. The farms should not be turned over as the prairies were—unbroken, unfenced, without accommodations for men or animals. There should be prepared homes, all of which can be constructed by the men themselves and paid for by them under a system of simple devising by which modern methods of finance will be applied to their needs.

"This is not a mere utopian vision. It is, with slight variations, a policy which other countries are pursuing successfully. The plan is simple. I will undertake to present to the Congress definite projects for the development of this country through the use of the returned soldiers by which the United States, lending its credit, may increase its resources and its population and the happiness of its people with a cost to itself of no more than the few hundred thousand dollars that it will take to study this problem through competent men. This work should not be postponed."

The Passing of the Machine Trade

BY ENTROPY

Our grandfathers tell us of the time when a man who built a house was expected to build it all the way through from the laying of the cellar wall to the plastering and paper hanging. If he were a complete craftsman he could then go on and not only make but design the furniture. In our own time we have seen machinists design and build machine tools, and it is only recently that we have seen the designing and the manufacturing done by different people.

The war is bringing upon us a still greater change. We no longer expect to see men in our shops capable of running more than one or two machine tools, or who thoroughly comprehend mechanical matters. The few all-around men that are left have been made gang bosses, foremen or even superintendents.

If this continues a great and permanent change is inevitable, for it will no longer be possible for any but the most brilliant men to come up through the shop. The only way that they can do it will be by stealing the trade; that is, by working in one shop as a lathe hand, in another as a planing-machine hand, and so on, often working on the same machine in several shops before the necessary variety of work is encountered. This will be a slow and painful progress and much more expensive than through the industrial schools.

Considering the almost infinitesimal number of such schools, and especially of those which are intermediary between the engineering and the strictly trade schools, this may seem a long way in the future, but things move rapidly under pressure of necessity, and the necessity is fast approaching. We are facing the inevitable loss of many of our young men, the very ones upon whom we have been depending for the building up of our industries. We cannot wait for those who will follow them to be trained in the school of hard knocks, and we must recognize that no matter how effective that school is it is far from efficient.

We will simply have to train them purposefully, and the men who now sneer at the graduates (there are still some of them left) must turn to and help them learn to fly instead of merely pushing them off the perch.

The question of who should pay the bill is one that is comparatively simple on paper. If the man who is to be trained has a large choice of employers to none of whom he is pledged, there is no doubt but that he should be trained at the expense of the community.

For example, a man trained in the machine-tool line should find free education awaiting him at the expense of the whole country, while one expecting to follow cranberry farming might reasonably expect Cape Cod to pay for his training. If on the other hand he finds his best opportunity in some unusual business, the processes of which are secret, there is no excuse for charging his training upon any except the business having these processes.

An unfortunate thing in this respect is that the young man who would like to become an expert in such a line will find himself handicapped unless he not only happens to measure up to the ideas of the employment man in that particular shop, but also presents himself at just the opportune moment.

It will, however, almost surely be found that there are fundamental principles which are common to these secret industries and to other and better known industries, in which case the additional training needed will not be more difficult than the learning of a few tricks of the trade.

It will require a considerable mental effort for us to discard the old idea that a foreman is a workman plus driving power (misnamed executive ability) and that a superintendent is a superforeman, but necessity is fast bringing us to the point where we can recognize the inability of the man who has come up through the ranks, without scientific training, to cope with the scientific developments which the war has brought upon us. In other words we have to realize that machine shops and methods have been unprogressive for the past 30 or 40 years for the simple reason that there was not enough money in the business to allow them to hire the men who could develop them.

It is noticeable that the graduates of engineering schools have steered clear of machine shops and especially of machine-tool shops. Now it is going to be necessary for them to take over that work and bring such shops up to the standards that have been reached in other lines of manufacture which have had for them greater attraction.

A Repair Kink on a Planing-Machine

BY FRED FRUHNER

Some time ago the cross-rail of our planing machine being badly in need of repair, and there being no other planing machine in the shop, we devised the following scheme for re-dressing it:

The cross-rail was removed from its normal position and set up on the table of the planing machine. A heavy plank was bolted to the housings where the cross-rail should be, and the head of a 25-in. Steptoe shaping machine firmly fastened to the plank.

By taking advantage of the swiveling feature we were able to run a cut in any required direction, and in the course of a short time the planing machine was in service again with a practically new cross-rail.

The Manufacture of Metal Beds

By Frank A. Stanley

This article illustrates and describes the methods used in pouring great numbers of cast-iron joints with the work set up in assembling fixtures and with chills for each joint, in which the parts are gripped and held ready to receive the metal.

CERTAIN features of the foundry practice of the Crescent Bed Co., Ltd., of New Orleans, La., are of such unusual character as to make them worthy of illustration and description. The impression one receives when he enters the foundry department of this company is that he is still in one of the factory sections—presumably an assembling room—until his attention is diverted to the men carrying hand ladles and pouring the joints of the long lines of work set up all through the department. The rows of frames upon which the work is mounted preparatory to the pouring operations appear at first glance to be assembling fixtures where the parts are put together for drilling. And they are assembling fixtures in reality, but not of the machine-shop type, for they are used as combination devices for holding the work while the joints, some 10 or 20 in number, are formed by pouring molten iron into the metal molds, or chills, which are provided at every point on the fixture where two parts are to be secured to each other.

The two interior views reproduced in Figs. 1 and 2 give a good general idea of the arrangement of these fixtures. Some of the fixtures are shown with the work assembled in place and ready for pouring the joints. At the left side and in the foreground of Fig. 1 will be noticed a fixture in a horizontal postition with the chills open and the material for assembling the members of an iron bed head lying near by. Several finished heads are shown at the front of the fixtures to the right.

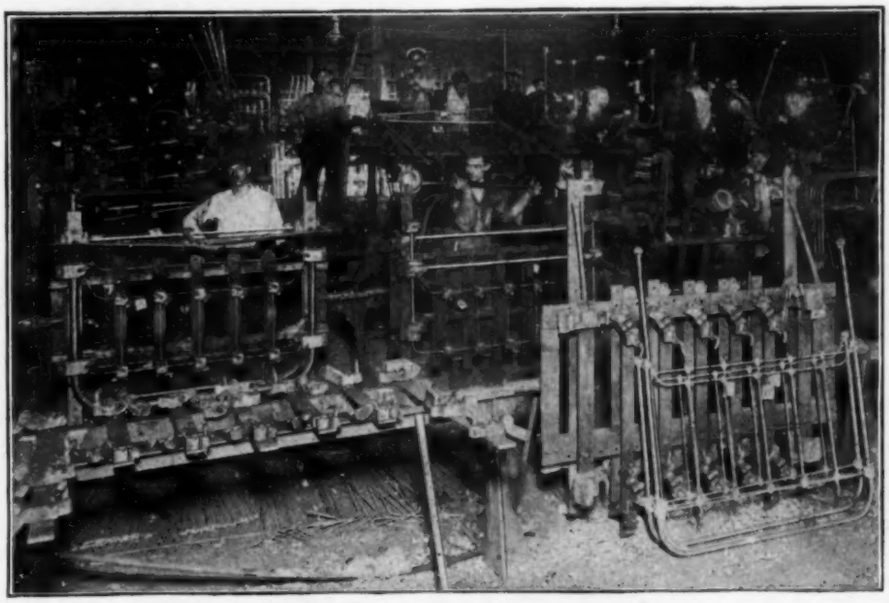


FIG. 1. A VIEW SHOWING SOME OF THE FIXTURES

The fixtures consist of flat, open tables, or frames, with extension arms at the rear and with trunnions at the ends, which are mounted in pillow blocks secured to suitable floor stands, the trunnions permitting the fixtures to be swung dowward into a horizontal position for the reception of the work and then tilted back to a vertical position after all the parts for the pouring of the joints have been secured in place.

Each fixture table carries a set of chills which are a combination of a clamp and mold and are made with hinged, or snap, lids located at an angle to allow both horizontal and vertical rods to pass into them and still clear the hinge lugs. The idea is sketched roughly in Fig. 3, where two chills are shown, one at *A* opened and one at *B* closed. It makes no difference what form the various rods and standards in the design may take; the hinged molds are shaped to suit each particular joint, and one design is poured as readily as another.

When the fixtures are swung up to a vertical position for pouring the metal, the work is brought bottom end up with the two standards or legs of the bed frame held at their ends in the molds at the extreme top of the upright extensions at the back of the fixture table. These uppermost chills provide for the casting of the enlarged collar or flange around the end of the leg at the point where a caster shank enters, the iron poured here thus serving the double purpose of an ornamental finish to the bottom of the leg and providing a reinforcement thereto for its open end. The molten iron is run from the cupolas as in Fig. 4, into small hand ladles holding about 25 lb. each, so that they are readily handled from mold to mold. The fixtures with the work to be poured are located in aisles directly opposite the cupolas, and the workmen with the ladles pass quickly from one fixture to another, the amount of metal poured into each chill being of course very small.

As fast as the row of fixtures are poured they are tipped down flat and the chills opened, the work removed

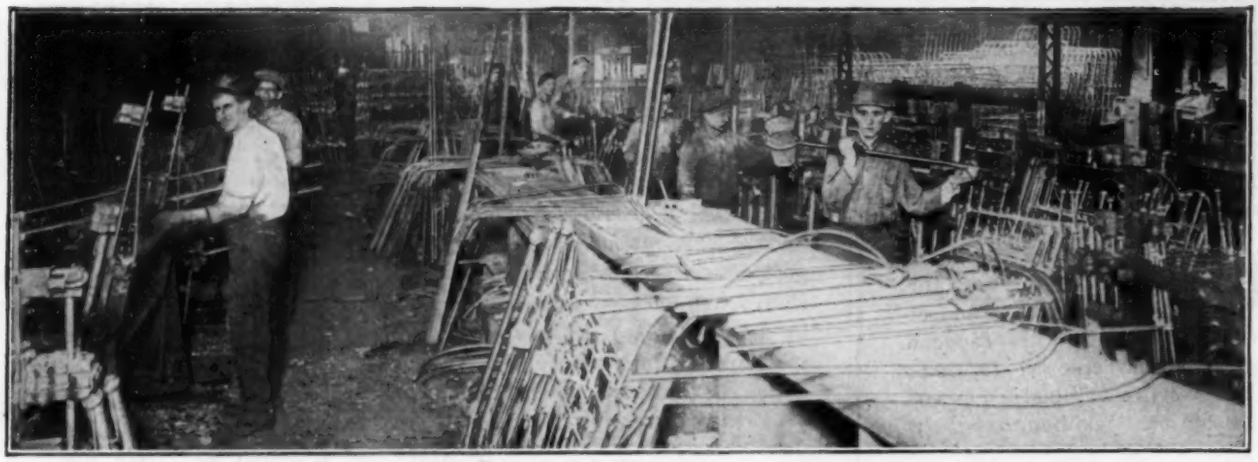


FIG. 2. THE FOUNDRY DEPARTMENT SHOWING FIXTURES HOLDING ASSEMBLED WORK READY FOR POURING. SOME OF THE COMPLETED WORK IS ALSO SHOWN

and a new set of tubes and rods inserted to form the assembling for the next job to be poured. There are scores of these fixtures in the department, and the pouring of the joints constitutes what is practically a continuous process.

The operations of setting up and pouring a different form of job but with a somewhat similar class of fixtures are illustrated in Fig. 5, where a row of side frames will be seen gripped at the ends in hinged iron molds. The man in the foreground is engaged in the work of setting up the job for pouring, while the other one is coming down the line at the rear pouring one rail end after another.

The operation on these rails consists in forming the dovetail head at each end, which allows the rail to be dropped into and held in sockets cast on the inner faces of the bed standards. The casting of the lugs is accomplished with double molds or chills at each end, two rails being attended to at one setting.

The engraving, Fig. 6, shows some interesting forms of construction in the way of assembled frames with cast joints, and further illustrates a method for finishing such material by the bronzing process without hand labor. The frames to be bronzed are coated with a

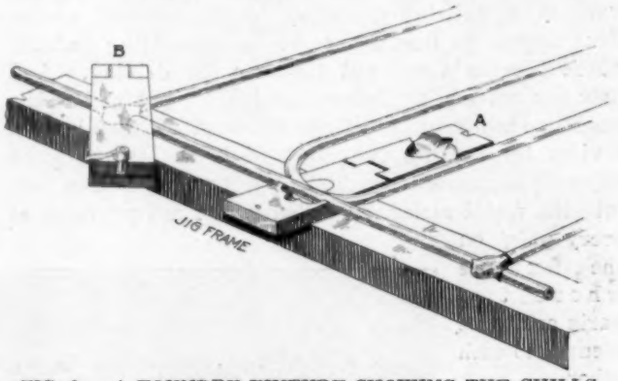
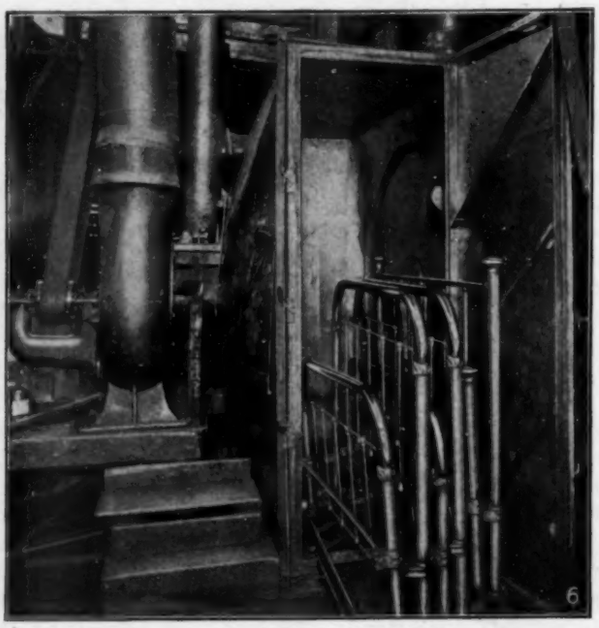


FIG. 3. A FOUNDRY FIXTURE SHOWING THE CHILLS

sizing material and placed on a narrow truck which is adapted to slide nicely into the tall closet-shaped apparatus. This is lined tightly, and at one side is an open-

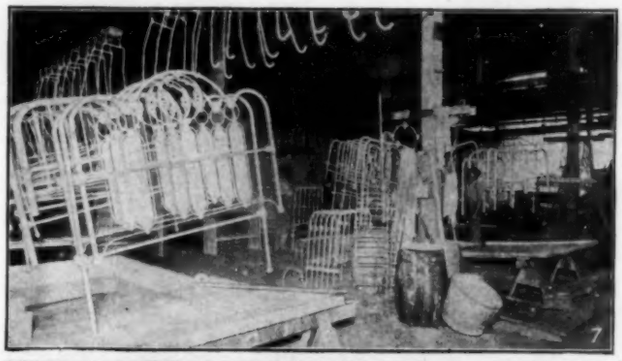


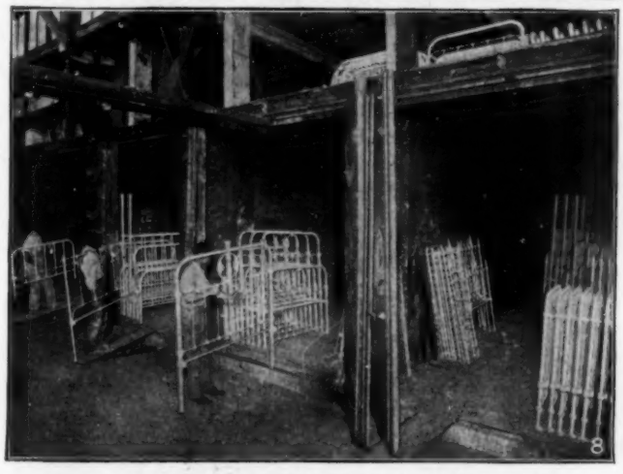
FIGS. 4 TO 6. POURING AND BRONZING
Fig. 4—Tapping the cupola. Fig. 5—Pouring side-rail heads. Fig. 6—Bronzing machine

ing for an air inlet from the big blower pipe at the right. When the door is closed upon the work a series of clamp handles are turned to hold the door snugly against a gasket.

A small quantity at a time of the bronzing powder is placed in a valve-controlled inlet at the rear, and then the air inlet is opened, with the result that the air currents carry the powder into contact with every portion of the work surface, where it adheres to the sizing, and all superfluous powder is blown off, to be later reclaimed by carefully brushing the interior of the compartment.

Two other views of interest and valuable as suggesting methods of handling other lines of material in other departments are reproduced in Figs. 7 and 8, the first representing the process of enameling by dipping in large tanks with draining platforms adjoining and then suspending from overhead hooks mounted on carriers adapted to be operated along a trolley rail. Fig. 8 illustrates the comprehensive installation of baking ovens, to which the work is brought direct by the trolley system and which are of such ample dimensions as to allow a great deal of material to be taken care of in each baking operation.

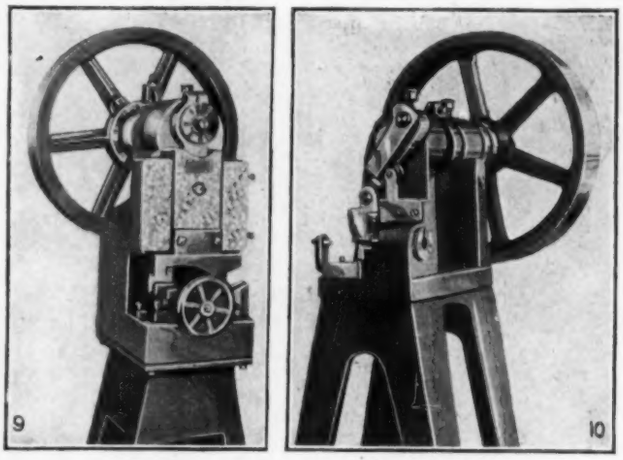




FIGS. 7 AND 8. ENAMELING PROCESSES
Fig. 7—Apparatus for enameling. Fig. 8—Large baking ovens

We come now to a consideration of certain important operations in the factory proper for handling parts of side rails, angles, pipes for bed frames and so on, and also for manufacturing some of the wire parts by methods that are of general interest. Two important machines used for bending, twisting, punching and the like are represented by Figs. 9 and 10. The press in Fig. 9, while of the conventional form in general appearance, is adapted to handling a wide range of work a little out of the ordinary for equipment of this character by the application of special features.

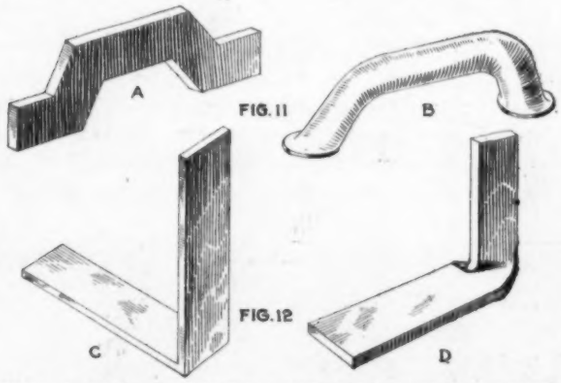
In place of the usual bolster a fixture is fitted to the press for holding the lower die and work, while the upper die used for bending operations is a heavy appliance abutting against the lower end of the ram, but secured to that member by a vertical flange at the front.



FIGS. 9 AND 10. SPECIAL PRESSES
Fig. 9—Press for special bending operations. Fig. 10—Press for bending and twisting

Two characteristic pieces of work shaped to the desired angle of a bend by a device of this sort are shown by Fig. 11, the example at *A* being a flat angle bent to 45 deg. at each end, while the other sketch at *B* shows a piece of 1¼-in. pipe similarly bent to an angle at the ends.

The lower die for work of this description is in the form of a V-block of the desired width and angle of a V and with an open V at the right and an inverted V at the left in the one die, so that with a piece of work like that at *A* the straight portion at one end of the piece will be formed parallel with the center of the body at the same stroke as the angle of slope is produced for that end of the bar. On reversing the job in the die the opposite end is bent to the correct angle with its outer straight portion corresponding in offset to the other straight end.



FIGS. 11 AND 12. WORK DONE BY SPECIAL PRESSES
Fig. 11—Bent work. Fig. 12—Bent and twisted work

The machine in Fig. 10 is for bending and twisting flat slats and similar parts at one operation, making

a square bend and then twisting the work around short at the end. When the work is entered into the dies or jaws at the side of the machine the first movement of the press bends the end up to the form indicated by *C*, Fig. 12, and then the end is caught by dies worked by cam motion and given the short twist around until

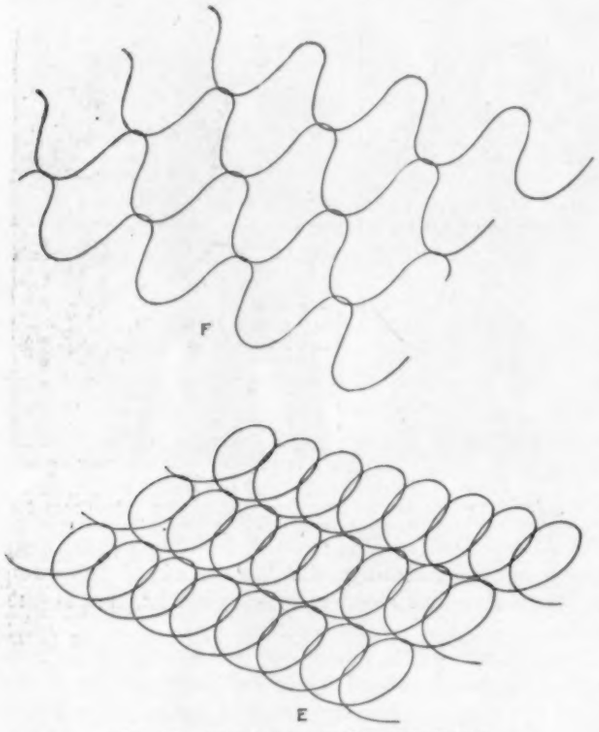


FIG. 13 WIRE-WEAVING METHODS

the flat side of the stock stands at right angles to its former position, as shown at *D*. By changing the dies any length of bend can be made as desired.

A number of years ago when "expanded metal" came into use a good many of us were surprised to learn that the process of manufacture consisted briefly in shearing staggered rows of slits in the sheet metal and then pulling the material sidewise to stretch its slits open into diamond-shaped spaces, leaving narrow bars of stock between. There is no waste in such a process, and the name given the product was indicative of the method of turning it out. But few would have guessed just how the material was manufactured had they been asked, and this thought of the simple way in which some designers solve an apparently difficult problem came back to mind when I saw for the first time the "weaving" of a wire mattress.

The operation of weaving the mattress consists virtually in coiling together long rows of open spiral springs and then stretching the coiled material until

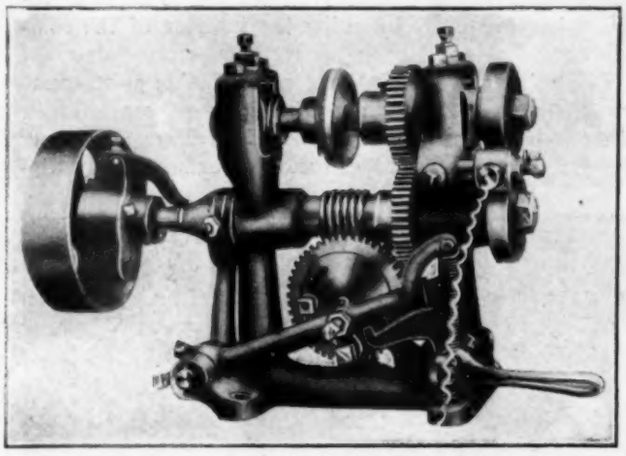


FIG. 15. WIRE-COILING MACHINE

it assumes a flat surface having every appearance of diagonally arranged, woven lines of wire. That is, a long coil is made, as indicated at *E*, Fig. 13; the next spring coiled in the machine is led out into the coils of the first, and then a third is coiled into the second, and so on until a sufficient number have been woven together to form the mattress, when the stretching operation is applied to flatten out the coils, as at *F*.

Along the edges, and at intervals of 8 or 10 in. across the width of the work, extra coils are woven in for strengthening and stiffening the wire fabric these being left in original form without the flattening due to stretching. This feature is visible in Fig. 14.

The forming of the woven lines in this machine is of interest to mechanics because it so closely parallels the manufacture of wire springs for general use where sufficient quantities are required to make it advisable to

FIG. 14. HOW THE WEAVING PROCESS IS APPLIED

use a special coiling machine for the purpose. The principal features of the machine are shown in Fig. 15, where one of the coils to be woven into the mattress will be seen issuing from the dies.

The wire is taken from a reel at the rear and is fed into the machine between a pair of rolls located close to the coiling arbor around which the spring is formed to the desired diameter and pitch and from which it leads out onto the long table in front of the apparatus. When the spring has been formed to the predetermined length the machine automatically cuts it off and a new spring is started. This second spring is led into the first and then follows along its whole length, weaving its coils into those of its fellow spring, and thus the process continues until the required width is built up.

The drive for the machine is by a friction clutch, which releases the pulley when the desired length of spring has been produced. The spindle of the machine operates the feed rolls through the medium of a pair of spur gears, and the knock-off mechanism for the drive is actuated by the worm gearing shown. The worm mechanism provides a reduction of about 60 to 1, so that the wormwheel will rotate at the most something less than a complete turn during the coiling of one length of wire. This permits the adjustable knock-off dog carried by the wheel to be set around in its slot to the point necessary for stopping the machine when the exact length of wire has been woven. The function of this dog when it contacts with its stop is to trip the friction-clutch mechanism by means of a rocker arm which extends forward across the face of the worm gear.

When the machine cuts off the wire the new length is started through the weaving process by the operator stepping on a foot lever which throws up the side lever and engages the driving clutch.

In connection with the operation of this machine it is of interest to note that something like a half mile of wire is woven in the production of each mattress, and there is not one inch of wasted material in the entire process.

Another wire-working operation that should appeal to shop readers as showing the diversity of product obtainable from automatic equipment designed to handle this material is the manufacture of links by the machine illustrated by Fig. 16.

This automatic machine is so constructed as to permit of adjustments necessary for various lengths of links and by mere changing of dies practically any style of wire link can be made. These links enter into the construction of what are known as link fabrics, or mattresses made up of numbers of V-shaped links hooked together and forming a flat surface looking like a coarsely woven-wire netting. The links ordinarily average about 4 in. long on each arm with a spread between the ends of the arms of about 2¼ inches.

The wire is about $\frac{3}{32}$ in. in diameter, and as it comes off the reel it is straightened before entering the dies by a 12-roll straightener. It is caught by the feed jaws on the levers just beyond the straightening rolls and passed into the machine, where three disk cams on the main shaft at the rear cause the cutoff dies to sever the stock to right length and force the wire blank into a form of curling dies, where the ends are formed into a short loop or open eye. Another cam forces the work into the bending die for folding it in the middle to V form, after which the work shoots out of the machine and slides down an inclined rod which when filled is removed and replaced with another.

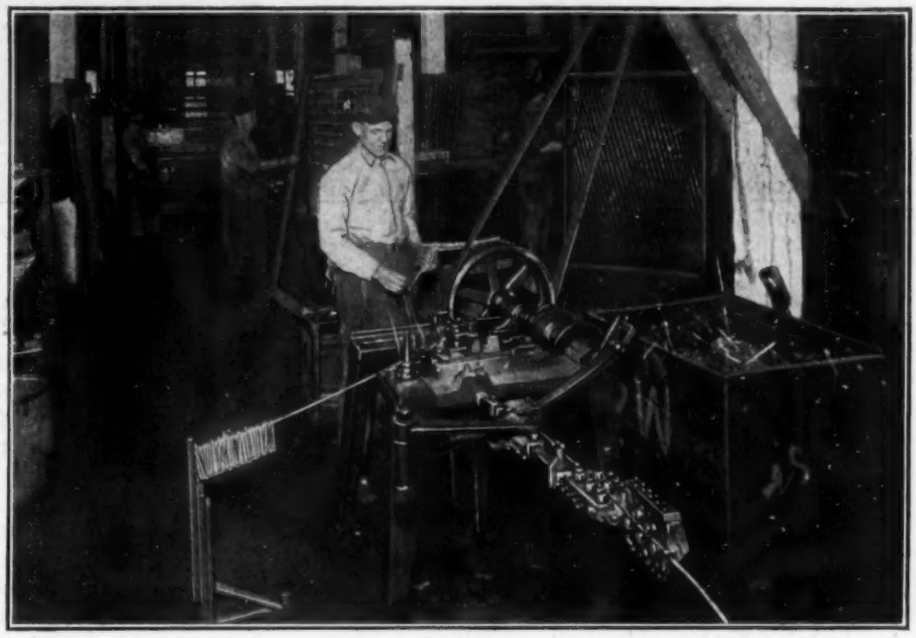


FIG. 16. WIRE-FORMING MACHINE

Engineering Societies Library Service

Engineers outside of New York are served by the Engineering Societies Library in several ways, according to statements made by Alfred D. Flinn, secretary of the Engineering Council, during a trip through the West. Letters from outside engineers are turned over to a special assistant who searches for the answer to questions and compiles a list of references to books and articles which seem pertinent. This is mailed to the inquirer. In many cases much of this material is available in local libraries. Whenever it is not the Engineering Societies Library will make copies of any or all of the references, translate them into foreign tongues, and, in fact, do anything it can to get information to the inquirer. For these special personal services fees are charged sufficient to cover the cost of the time spent on them. The present price for searching is $1.50 an hour; for copies, 25c. a page and for translations from $3.50 upward a thousand words. Some 2200 inquiries have been handled in the three years that this service has been in operation.

A PORTABLE MACHINE SHOP INSTALLED IN NARROW-GAGE ROLLING STOCK

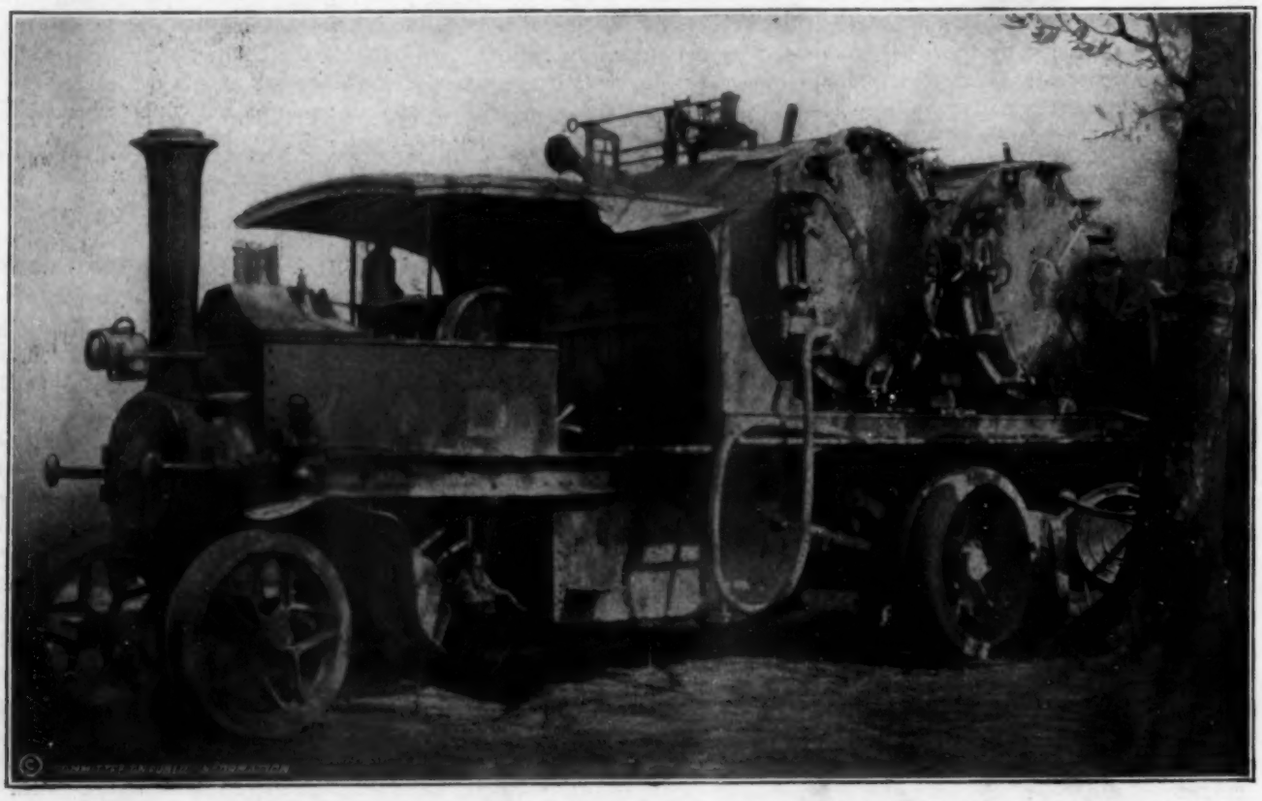
With Our Army in France

READERS will be interested in the two illustrations presented herewith which show how two different phases of the necessary army work are handled. The one at the top of the page shows one of the many machine shops while that at the bottom shows how one sanitation problem is dealt with.

Groups of four or more cars, each 20 ft. long and 5 ft. 4 in. wide, shown in the illustration, constitute machine shops on wheels on the light railways (60-cm. gage) at the front in France. The equipment in such a shop includes drilling and grinding machines, hacksaws, lathes and planing machines operated by power from one of the standard petrol-electric tractors, which if occasion demands can haul the machine shop forward or backward. The shop remains in one location, however, unless it is decided to change the light-railway base. The sides of these machine-shop cars are hinged at the bottom and open outward, forming extensions on each side.

Where the nature of repair work is too heavy or complicated to be handled readily in the field the rolling stock is shifted to a large central repair plant thoroughly equipped with machine tools, spare parts and appliances of various sorts for rehabilitating engines or cars which suffer some "shell shock" or other ailments incidental to light-railway operation.

The machine below is used on the western front to kill the vermin in our soldiers' clothing, which it does quickly and effectively. The clothing is placed in the large drums and steam turned on. The clothes are then dried and returned to the owners.



A PORTABLE "COOTIE" COOKER IN USE BY OUR ARMY IN FRANCE

Emulsion Lubrication of Cutting Tools

By J. A. De CEW
President Process Engineers, Limited, New York

The most efficient lubrication of cutting tools is at the present time a very important problem to the machinist, although the seriousness of the subject can only be appreciated after a careful consideration of the results that can and should be obtained.

MUCH scientific study has been given to the lubrication of bearings, but owing to the many variable factors it is still difficult to so apply the materials available that the best results are obtained. But in the lubrication of a cutting tool there are new governing factors which as yet have received little study. In fact any real investigation of the matter has been practically impossible because the knowledge of the composition and manufacture of the compounds used for this purpose has been isolated from the methods of use and the results obtained.

In order to better understand the subject let us first consider the things that are required in lubricating a cutting tool, and then the factors most essential to these results.

The aids that can be given to a cutting tool and the work are:

First—To keep it cool.

Second—To reduce the friction on the surface of the tool which is pushing it aside.

Third—To reduce the friction on both surfaces of the cutting edge where it enters the material and before the shaving is performed.

Fourth—To cover the finished material with a film of oil which acts as a protective coating and prevents corrosion.

How can we combine in one material all the properties that will give the above results?

Mineral Oil

Let us first consider the use of a mineral oil which we will feed directly onto the tools, reclaim the excess and return to the work until exhausted.

We find that in the first place it does not keep the tool as cool as it should because of its low specific heat and poor thermal conductivity. Secondly, experience has shown that it does not always give satisfactory lubrication of the penetrating surfaces, possibly on account of the viscosity of the oil. Thirdly, an excessive amount of oil remains attached to the work and shavings, a part only of which may be recovered.

Where cutting speeds are not too great, and where good cutting action is desired, it is customary to use an animal oil, such as neat's-foot, which may be blended with the mineral oil to increase its lubricating qualities. In such a case the cost of lubrication may be excessive because of the heavy film of oil which remains with the material treated.

There are certain classes of work where the cooling of the tools is a matter of equal importance as is the lubrication, and for this purpose the only suitable material is an aqueous lubricant. An aqueous solution is the best lubricant for a hot tool because it has the greatest specific heat, or in other words it will take more heat to warm it than any other substance.

It has a greater heat conductivity than oil, therefore the heat will be carried away from the tool faster than it will by oil alone. The whole point then is, Can an aqueous lubricant be made which will actually lubricate the tool? It is obvious that a solution of water and soda will not do this, because the alkali has no lubricating properties in itself and only feels greasy when it can attack an oily substance such as the surface of the human hand.

Oil Emulsions

It has been known for a long time that an oil can be made to separate into a number of fine particles by first blending with it some substance which is soluble in water and then mixing the compound with a large amount of water. The material blended with the oil is called an emulsifying agent, because when it leaves the oil and dissolves in the water, for which it has the greater affinity, the oil is left in finely divided particles which float in the aqueous solution and produce what is called an emulsion.

The compounds that are used commercially for lubrication by mixing with water all produce emulsions in the manner described. In these the water is the cooling agent, while the emulsifying agent has no particular action other than being the means of producing the emulsion.

The solvent or emulsifying agent, being generally more expensive than oil, is only used in sufficient quantity to cause the emulsion to form. The lubricating efficiency of these emulsions must therefore depend upon the action that these suspended oil particles can exert toward reducing the friction on the tool surfaces which come into contact with other metal.

As the oil particles in suspension are carried mechanically into contact with the hot tool surfaces, some of them must be interposed between the contact parts and thereby produce some lubricating action.

The coarser oil particles will be prevented by their size from penetrating as far between the surfaces as the aqueous medium, but the finer particles, which are microscopic in size, will not filter out, but will follow the solution and perform efficient lubricating service. This has been demonstrated by tests with different aqueous lubricants in which emulsions containing oil in different states of subdivision have been used. The same compound may be mixed with water by different means, thus producing emulsions different in physical character.

If the compound is slowly stirred into water, either warm or cold, very white emulsions are likely to be produced, from which a portion of the oil will gradually separate if allowed to stand for a time. This indicates decomposition between the solvent and the oil, and the amount of decomposition is increased with the amount of water added. If, however, the compound is

diluted in water by means of pressure, using special apparatus and proper temperatures so that instantaneous solution can take place, then the solvent may be diluted with water without breaking up its combination with the oil, and a diluted solution is obtained which resembles in character the original compound.

By such methods a solution may be produced which may be as dilute as 50 parts of water to 1 of compound, and yet the oil will be so intimately combined with the solvent that it will remain partly in colloidal solution and partly in the form of an emulsoid, which is a state of division much finer than emulsions or suspensions.

The lubricating power of such a solution has been shown to be much greater than if the same material had been broken up into emulsions, and this is explained by the fact that an aqueous solution of oil is in actual existence and the water really has lubricating value.

When a colloidal solution of oil dries on a metallic surface it leaves a film which acts as a protective coating, and no rusting of this surface can take place for a considerable time. This has proved to be of much importance in the manufacture of munitions.

By the development of the art of dilution by means of physical processes, a considerable economy can be effected in the use of the mineral and vegetable products that are used as solvents or emulsifying agents. It is possible even to eliminate the use of the saponifiable oils and fats which are now largely used as emulsifying agents in this art, and this conserves a large amount of these materials for other purposes.

With regard to the use of emulsified materials for any purpose it is now an established fact that colloidal solutions and emulsions are much more efficient than the coarser state of dispersions such as emulsions and suspensions, the colloidal condition representing the finest state of subdivision obtainable and the suspensions representing the coarsest state that exists without immediate separation. The technical development of this art, as applied to lubrication, is quite new, but the field of application is very broad.

Charcoal Regulations

To provide for the better distribution of charcoal the United States Fuel Administration has promulgated regulations covering the distribution of carload lots, together with the maximum prices which may be charged by the producer therefor. Under the regulations the maximum prices of charcoal in car lots shall be: Lump in bulk, 20c. per bushel; lump in bags, 22c. per bushel; screenings in bags, 20c. per bushel. All the maximum prices apply to car lots sold to consumers or to dealers for wagon delivery. Any commission paid to selling agencies or margins allowed to jobbers shall be paid by the vendors and shall not be added to the established prices. Where wagon deliveries are made by the producer to the purchaser a reasonable charge for such handling may be added subject to the approval of the federal fuel administrator for the state in which such deliveries are made. Where charcoal is shipped in bags the actual cost of the bags may be added to the prices given. The purchaser may return bags suitable for refilling to the point of shipment within 60 days after date of shipment, in which case the price charged for the bags shall be refunded.

Jack to Bill

Deer Bill:

Youl be supprized to lurn that Ime agoin to Jack up my jobb, but I bee, and Ile tel you wy and awl about it. Ive bin adoin peese wurk on my slotr, Bill, and amakin good munny, not of cors wat a man of my xpeerins and a awl round skild mekannik like I be ort to git but bettern 50 $ a weak.

I thort Ide maik a pile out of my paytunt, you no wat I rote you about improovin the arebrake, but the foarman him and me is prooty chummy he says go and tawk to the big bos heel treet you wite, and wood you bleev it Bill, he says sum one has bin foolin me and slingin bool in2 me and its awl a lie about them iurn bottels under the cars beein sent off to be fild for 8 $. But that isent wy Ime agoin to Jack up but the men is agoin on strike and I wunt.

I aint slotin no Huns on my slotr, to be shure, but evry peese I maik is hellpin Uncle Sam to rush men and guns and grub and sutch to hellp swat them dodgasted botches (that wurd meens jurmans Bill) and I wood think myselff a meen durty son of a you no wat, Bill, to strike now and be estabbin Uncle Sam in the back wen both his two frunt hands is bizzy ringin the neks of the dadbloomin botches, woodent you Bill? But if I stay and wurk thayl cawl me a skabb and problikely kil me sum dark nite. And how cood I evr again look myself sqware in the face if I went on strike now wen evry man is needid to hellp beet them botches? And I think evry man wat strikes now ort to be poot in the frunt trenchis if hes a merican and if not stood up befoar a firein squod, dont you Bill?

And I most wish in room of lurnin to be awl the kines of speshlists thare is in the traid Ide ave took corsponduns lesuns in fitein so praps Ide be a genrul, but dont you think Bill a awl round skild mekannik like I bee wood be mitey yuseful hellpin on flyoplains? Or wood you think now I no awl about steem from wurkin a year in a ralerode shopp Ide be dooin moar agenst the botches if I went in the navey to taik cair of the enjuns? But Ive prooty neer maid up my mine to try furst to be capptin of a flyoplain and if not that to be enjnear of one. So next you heer from me Ile likely be lurnin to fly, but one thing is shure Bill I wunt be no striker ahellpin the Kizer git reddy to maik a Beljum out of this country. Ive rote a pome, you dident no I was a poit Bill.

The langwij aint floury like if Ide ave give my mine to it wen I was yung, but its prooty fare for a beginr dont you think so Bill?

Ide ruther be a hogg on garbij fed
& maid in2 good sossij wen Ime ded
Than one of them two-legged hoggs in pants
That wen thare frens is fitein Huns in Franse
In room of wurkin fathefuly and wel
Goes out on strike and raises merry (you no wat that next wurd ort to bee, Bill, but I dont want to rite it for feer your wife mite git to see this letr).

JACK.

P. S.—Bill do you bleev wat thay tels me that wen the enjun of the flyoplain gits stawld the enjnear has to git out in frunt and crank er up? Thay tels me he stans on nawthin and the flyoplain goes so fast he carnt fawl.

Early History of the Marine Torpedo

By H. H. MANCHESTER

The prototype of the torpedo was a device for setting fire to ships and fortifications and was used before the invention of gunpowder. It is surprising to learn that as early as 1285 the quick burning of salpeter was utilized to propel fire balls on the water toward the object to be destroyed. After the invention of gunpowder, explosive vessels were used, and as early as 1585 clockwork was used to time the explosion. Fire balls and torpedoes were first propelled from mortars about 1630.

THE earliest known direct ancestor of the torpedo may reasonably be recognized in the fire ship, in which the inflammable materials used were the nearest approach to powder known in ancient times. The fire ship was called "a floating engine of destruction," a term which might be applied to the torpedo.

The first mention of fire ships in history, it appears, was in 332 B.C., when Alexander the Great was besieging Tyre. He was constructing a mole to connect Tyre with the mainland, and had erected two wooden towers to protect the workmen. The Tyrians sent fire ships against the towers and the wooden part of the mole and created such havoc as to delay the taking of the city for several months.

A first step toward spar torpedoes may be seen in a device of the ancient Rhodians, who fastened kettles filled with pitch to the end of long poles. Igniting this, they attempted to set fire to the enemy's ships.

Additional effectiveness was given to such means of attack by the invention of Greek fire. For centuries naphtha had been employed for firebrands to be used in war, but Greek fire is believed to have had other important constituents. It was brought to Constantinople from Syria in 673 A.D. by a certain Kallinikos, who claimed to be its inventor. The substance was

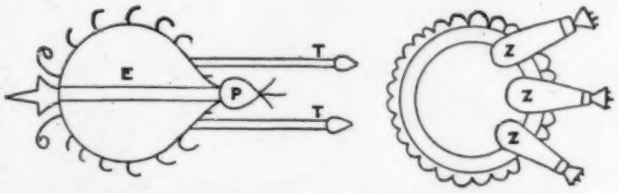


FIG. 1. ROCKET-DRIVEN TORPEDO AND A FIRE BALL, 1285

called "wet fire" because it would burn on water. For this reason it is thought to have contained quicklime and sulphur as well as petroleum or pitch. Under the direction of Kallinikos it was used succesfully by the Eastern emperor to burn the fleet of the Saracens and enable him to win the battle of Cyzicus in 678 A.D.

In 951 and 953 Russian fleets were badly damaged by fire ships and vessels filled with all kinds of inflammable materials were not infrequently employed during the Crusades.

Self-moving torpedoes were contrived even before the invention of firearms. The Arabian Hassan Al Rammah Nedschm Eddin even pictures some in his war book which was written in 1285. In Fig. 1 the illustration at the left represents what he termed "a self-driven and ever-burning egg." He probably called it an egg because of its shape, and it consisted of two concave iron plates such as are even now used by the Arabs in baking. These were fastened together and made pracically watertight by means of felt, forming the hollow vessel *E*. Before joining the plates the vessel was filled with naphtha, chips of metal, and what Hassan calls "a good mixture," by which he means one strong with saltpeter. The large rocket *P* was provided, the reaction from the discharge of which drove the torpedo forward. The two poles *T* and *T* were to give balance and direction.

The figure at the right was called a top. It was a hollow body filled with a strong saltpeter mixture and with the surface covered with tar, wax, naphtha, sulphur,

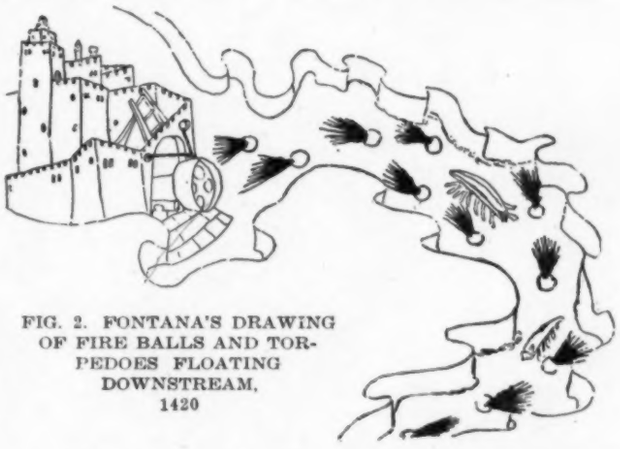


FIG. 2. FONTANA'S DRAWING OF FIRE BALLS AND TORPEDOES FLOATING DOWNSTREAM, 1420

etc. It thus formed a fire ball, the outside of which burned until the fire reached the inside, when there followed more or less of an explosion. The three tubes *Z* acted as fuses to carry the fire to the inside.

Another great step in the destructiveness of the torpedo was the application to it of gunpowder, which was probably invented in the thirteenth century, but the use of which did not spread until after the invention of cannon in 1313. Konrad Kyeser had the idea of a barrel filled with powder which could be floated against the enemy's ships, and gave a picture of such a floating mine in 1405 in his work "Bellifortis." In this case the barrel seemed to have been merely set on fire before being sent down stream and there was apparently no contact ignition or timing apparatus.

A number of very interesting torpedoes were depicted by Joanes Fontana in 1420. One of his drawings, Fig. 2, shows 11 large balls of fire which have been thrown from a castle into the river and are floating down the current.

A more striking conception is illustrated, Fig. 3, by Fontana in a torpedo which was to be driven over the surface of the water by means of rockets. The rockets where to be lighted when the torpedo was a short way from the ship, and their discharge was to drive it against the vessel. The sharp spear-like prow of the torpedo was expected to be driven into the wooden

side of the boat, and to hold it there long enough for it to explode or set the vessel on fire. It was filled either with powder or a highly inflammable saltpeter mixture suited to the requirements of the occasion.

A rather grotesque drawing, Fig. 4, by Fontana illustrates the same idea of propulsion by a rocket applied

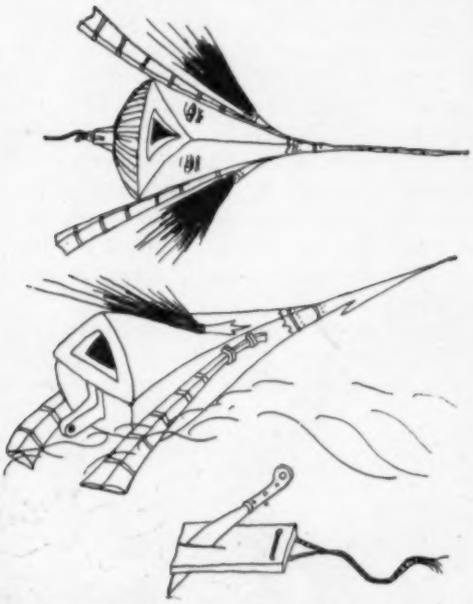


FIG. 3. ROCKET-DRIVEN TORPEDO, FONTANA, 1420

to flying, rolling and floating torpedoes. Here the flying torpedo imitates a bird, the rolling one a hare and the floating one a fish.

Leonardo da Vinci—that almost universal genius—about 1500 A.D. took up the old idea of the fire ship and added the use of powder to produce an exploding boat. A rough sketch of his, Fig. 5, shows that the boat was to be shaped somewhat like a low galley and be driven by sails.

Such explosive boats, Fig. 6, were put to practical use when Antwerp was besieged by the Spaniards in 1585. The English were at that time in alliance with the Dutch, and, under command from Queen Elizabeth, Federigo Giambelli, the Italian, constructed two explosive vessels which were named "Hope" and "Fortune." During the night of Apr. 4 the "Hope" was sent against a large wooden obstruction or bridge with which the Spaniards had blocked the mouth of the Scheldt. The result was all that could be expected. The explosion destroyed about 200 ft. of the bridge, killed some 800 Spaniards and did much toward preventing the capture of the city.

In the same year, clockwork, Fig. 7, was used by John of Nassau to time explosions. The advantage of this was that the explosive could be sent forth in the dark without being lighted and without forewarning the enemy.

Giambelli, at the behest of Queen Elizabeth, constructed in 1588 eight more explosive ships, which so frightened part of the Spanish Armada as to drive

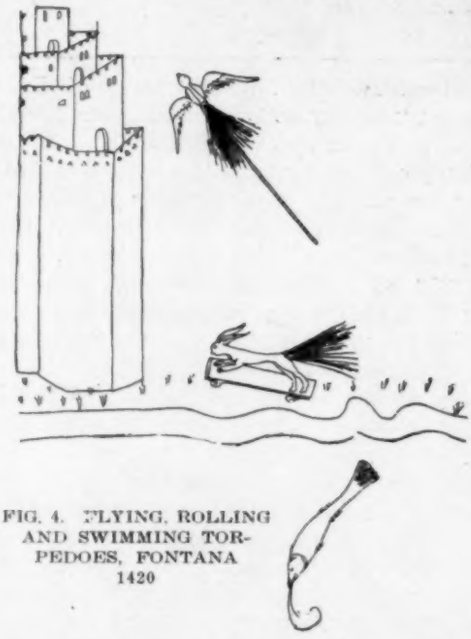


FIG. 4. FLYING, ROLLING AND SWIMMING TORPEDOES, FONTANA 1420

them out of the roads at Calais and prevent them from making a landing.

In 1628 Cornelis Drebbel, who it will be remembered experimented rather successfully with a submarine boat on the Thames in the presence of King James, devised a spar torpedo. This was practically a petard fastened

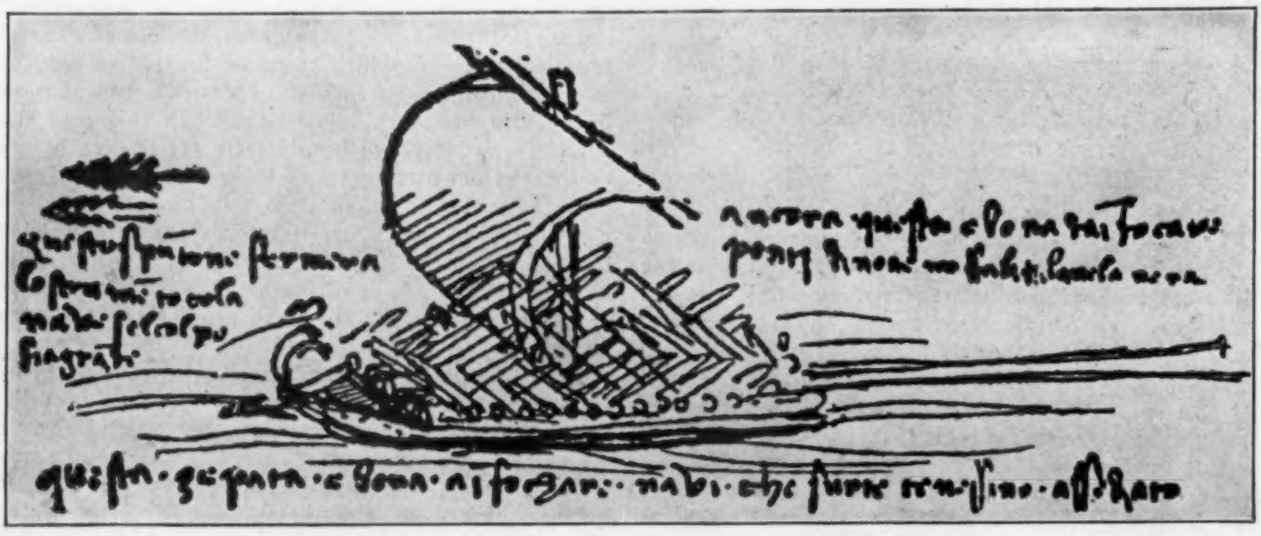


FIG. 5. DA VINCI'S SKETCH OF AN EXPLOSIVE SHIP, ABOUT 1490

to one end of a long pole. A number of these, as well as fire ships, were tried by the English in the siege of La Rochelle, but without any startling results.

In some ways it was considered a positive advantage

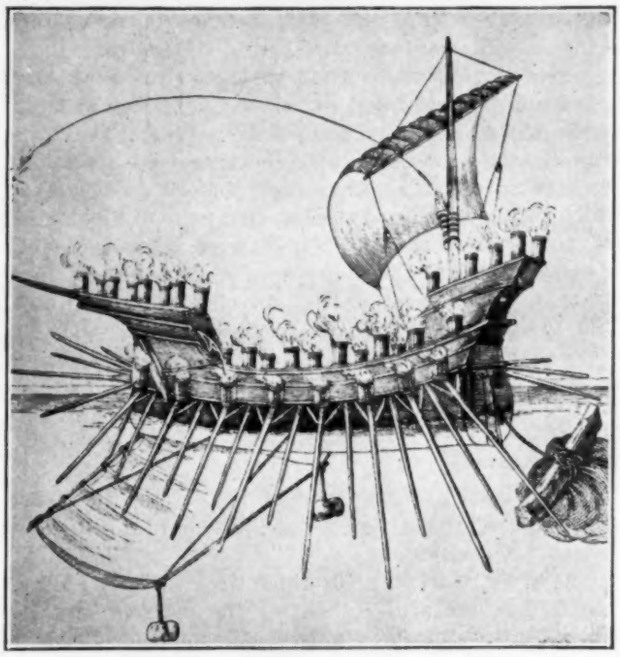


FIG. 6. EXPLOSIVE SHIP USED AT ANTWERP IN 1585

for torpedoes to give forth light when floating down stream against the enemy's ships, as they disclosed the position of the ships, and could scarcely be avoided even when seen if the ships were crowded together. Hanzelet

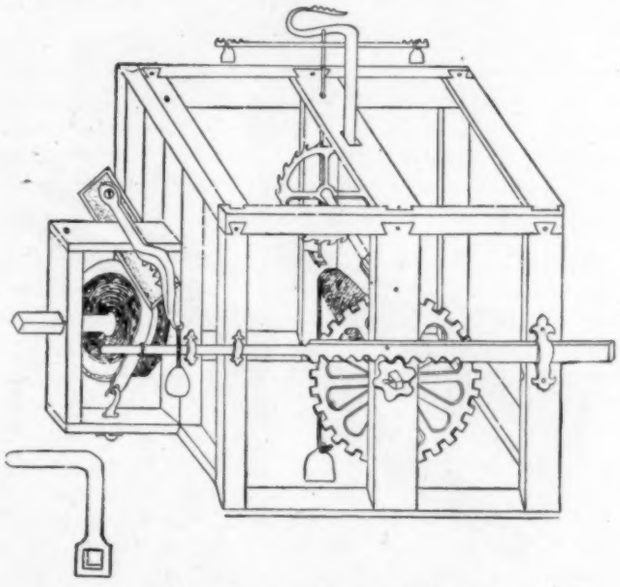


FIG. 7. CLOCKWORK TO TIME EXPLOSION OF FIRE SHIP, 1585

Lorain pictures mortars, Fig. 8, which could be used for throwing both torpedoes and fire balls, and describes how either could be constructed for use against a fleet.

Vessels filled with explosives were again tried by the English at Dieppe and Dunkirk in the year 1694. One of them was filled with 200 casks of powder, but did not reach as advantageous a position as was hoped for before it exploded.

The *Gentlemen's Magazine* for 1747 contains a design, probably by Denis Papin, of a vessel produced for Charles, landgrave of Hesse-Cassel, in imitation of Cornelius Drebbel's. This boat was made to be sunk beneath the water and had a horizontal tube through which a diver could crawl to fasten the torpedo to the side of an enemy's ship. The torpedo was to be exploded after the diver was at a safe distance.

Along with his experiments on submarines and steamboats Robert Fulton carried on a number of tests in regard to torpedoes. In 1805, about a mile off the home of William Pitt in England, he demonstrated that torpedoes could blow up a ship. The brig "Dorothea" was assigned to be the victim. Two torpedoes were fastened together by a line, and one carried in each of two rowboats. The torpedoes were constructed to sink when set loose in the water, but to be kept at a proper level by buoys. Only one of the torpedoes was loaded and clockwork placed in it to time the discharge. The boats were rowed out to the brig and the torpedoes

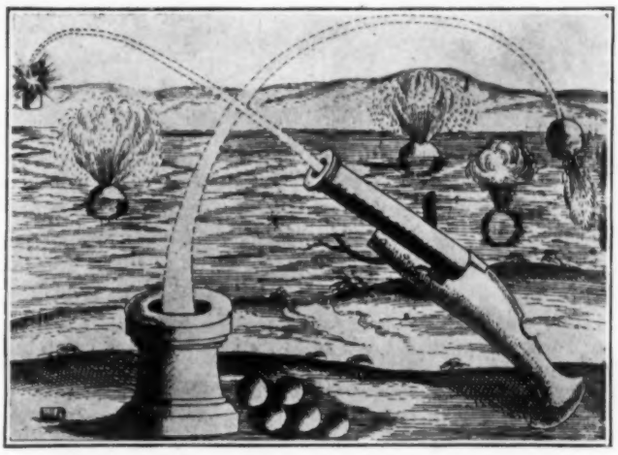


FIG. 8. MORTARS SHOOTING FIRE BALLS AND TORPEDOES, 1630

dropped into the water. The line between them caught on the bow of the brig, as planned, the torpedoes were driven underneath the brig by the tide, and after the 18 minutes' allotted time the loaded torpedo exploded. The effect was all that could have been hoped for, as the brig was broken in two in the middle and sank at once.

Fulton's Book on Torpedo War

In 1807 Fulton blew up a ship in a similar way in New York harbor. After his success with the "Clermont" Fulton again turned to the problem of torpedoes, and in 1810 published his small book, "Torpedo, War and Submarine Explosions."

This work contains two plates of considerable interest, which we reproduce. They show that by this time he had developed the idea of harpooning a vessel in the bow in order better to control the action of the torpedo which was to be fastened to the end of the harpoon. Fig. 9 shows the details of this device. *A* contains the gun lock with a short barrel to be fired into the charge of powder in *B*, and also clockwork to time the firing. *B* is a copper case for 100 lb. of powder; *C* is a cork cushion to give a certain buoyancy, but has holes bored in it so that the torpedo will gradually sink;

D is the buoy to hold the torpedo to a certain depth, and *F* is the harpoon gun.

As noted in a previous article the idea of fastening a torpedo under a ship was taken up by David Bushnell

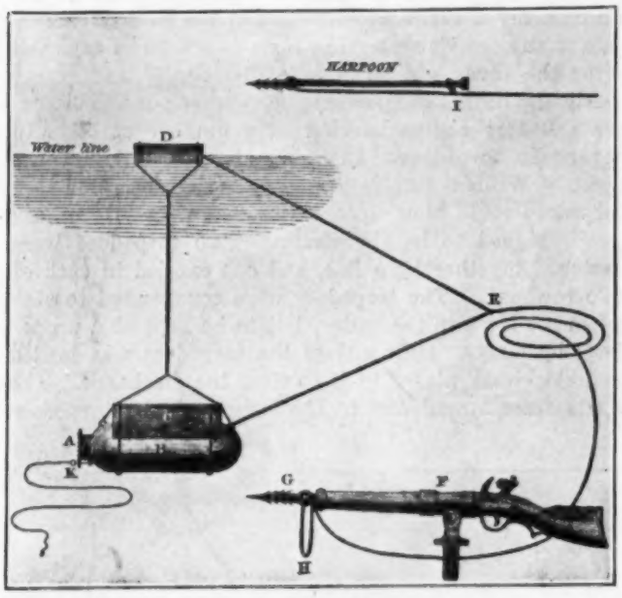
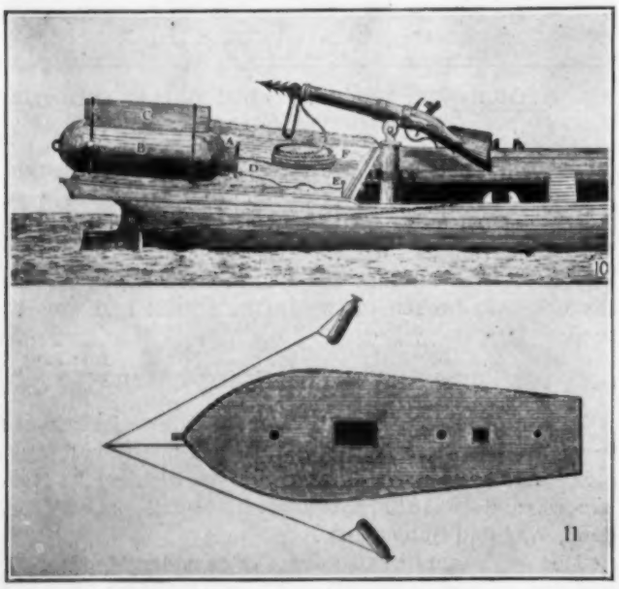


FIG. 9. HARPOON TORPEDO, FULTON, 1810

in 1776 and developed into his one-man submarine, the "Turtle." Among other things Bushnell should be credited with proving by experiments that powder could be exploded under water.

Bushnell also made several other notable attempts with torpedoes. In 1777 he set afloat a torpedo against



FIGS. 10 AND 11. HARPOON GUN AND TORPEDO AND THE RESULT OF THEIR USE

Fig. 10—Harpoon gun and torpedo on stern of ship, 1810. Fig. 11—Ship harpooned and torpedoes about to act, 1810

the British ship "Cerberus," which lay at anchor between the Connecticut River and New London. The machine was filled with powder which was to be fired with a gun lock. This was to be unpinned and thrown into action when it came in contact with the ship. The torpedo, however, floated into a schooner which lay astern of the warship, and upon being set off blew up the schooner, but not the ship.

In December of the same year, Bushnell filled a number of kegs with powder, constructing them so that they would be set off by a gun lock when it came in contact with a ship. He then fastened them together in pairs, and set them afloat in the Delaware River above the English fleet. The kegs themselves were below the surface of the water, but the buoys, which kept the kegs from sinking too deep, were visible. The work was of course done by night, and they were started at too great a distance. There was also ice in the river, which not only detained the kegs but caused the English to warp their ships into the wharves. The buoys did not appear where the ships were until after daylight. On being handled, one of the kegs blew up a small boat. This threw the English into great excitement, and they received orders to fire on everything which appeared floating in the river. The outcome was the more or less farcical engagement which one of the Revolutionary poets, Francis Hopkinson, celebrated in "The Battle of the Kegs."

In 1796 Edward Thomasson laid the plan for a steam-driven torpedo boat before the British Admiralty, but it was not carried out.

The other plate, Fig. 10, which we give from Fulton's book shows the arrangement of the harpoon gun and torpedo in the stern of a rowboat, and Fig. 11 shows a vessel harpooned with this device and with the torpedoes about to act.

The next step in the development of the torpedo was obviously to fire the torpedo itself against the ship, but this was not taken up for a number of years.

Staybolt Driving Tool

BY G. E. BALDWIN

A tool used for driving staybolts in boilers is shown in the illustration. This tool consists of a spindle with a taper shank to fit in a standard drill socket on a portable air or electric drill. On this is fastened a

TOOL FOR DRIVING STAYBOLTS IN BOILERS

special sleeve having gripping teeth cut on the inner surface. The shank is made of machine steel, while the chuck is of oil-tempered tool or tire steel.

Staybolts are driven by the use of this tool without the usual method of having to square the ends. The chuck grasps the round surface, gripping it firmly, while the staybolt is being driven into place.

This tool is in use in several railroad shops and has been found to be very efficient.

Accuracy in Setting Cores

By J. V. HUNTER
Western Editor *American Machinist*

The vast majority of cores set in molds in a foundry are supported entirely by the sand. Sometimes they require greater accuracy in the setting than can be obtained by supporting these cores in sand, and the methods here outlined for supporting them by the walls of the flask may be of interest to those who have similar problems to solve.

IT WOULD appear in many cases that patternmakers build up a pattern which necessitates the most delicate degree of accuracy in core setting and then overlook one feature that may be used to insure the result. There is a considerable amount of foundry work involving thin cored walls to which the method here described, primarily used for the production of cast-iron tanks for a car-heating system, might be advantageously adopted.

Galvanized sheet-metal tanks under about 30 lb. steam pressure were first used on these heating systems, but after several had exploded it was decided to use cast-iron tanks, whose increased resistance to corrosion and pressure would afford greater safety. A general idea of the shape of these tanks can be obtained from Fig. 1. They are about 22 in. long and

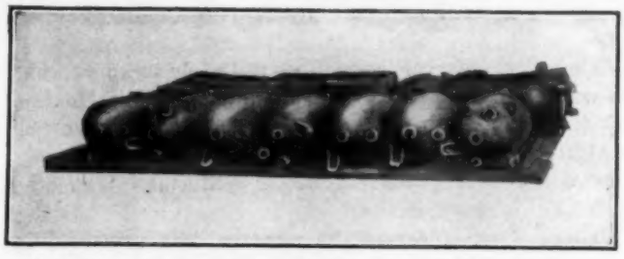


FIG. 1. A ROW OF TANK CASTINGS

9 in. in diameter with convex ends; the walls are somewhat less than $\frac{7}{16}$ in. in thickness and they have a number of pipe connections cast on their sides.

Trouble was experienced from leakage about the chaplets required to hold the core in position. The lifting power of such a core when surrounded with molten iron amounts to several hundred pounds, and perforated chaplets would press up into the mold surface, therefore long spike chaplets were used, extending through the top of the cope to a special blocking arrangement on top of the mold. The metal would not burn into these heavy chaplets, and the result was a constant loss due to leakage. Insufficient venting of the core (although this was extended through four extra 1-in. holes on the side, afterward tapped and plugged) caused further trouble from accumulations of gas in the interior of the casting, resulting in porous, leaky metal.

These troubles led to the determination to support the core directly from the walls of the flask by means of a pipe extending through the core; this pipe also serving for the removal of gas. The use of a pipe support in this manner involved planning all of the operations of core making and molding to this end, but such excellent results were accomplished that the change proved to be a decided labor saver, as in the work of setting the cores alone the mold production was increased almost one-third. A tapped and plugged

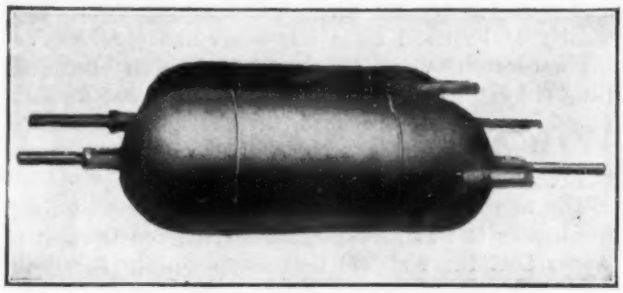


FIG. 2. CORE WITH PIPE IN PLACE

hole was required in each end of the finished casting at the point where the pipe passed through, but as these two holes took the place of the four formerly used the result was a further saving in machining.

A large number of $\frac{3}{32}$-in. holes were drilled in $\frac{1}{2}$-in. pipes along that portion which was to pass through the core. The core box was rigged with extensions on each end for holding this pipe in place during the making of the core. The pipe was removed during the baking of each half core, but was reinserted when the two halves were pasted together. Fig. 2 shows a completed core. Note that the sand extends in a thin

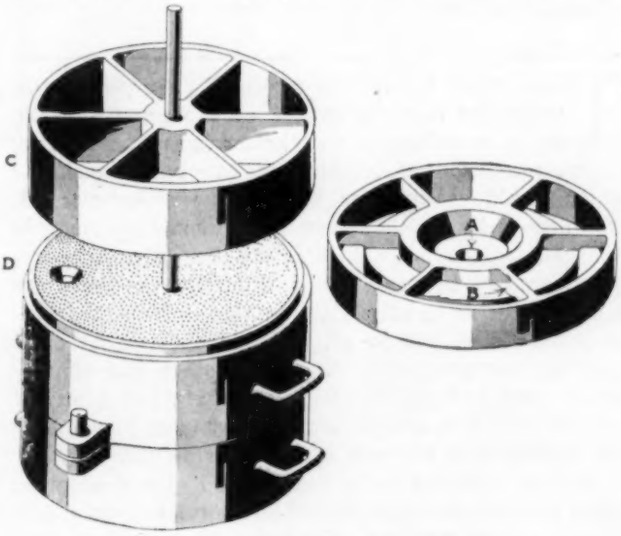


FIG. 3. CASTING-IN A PISTON ROD

collar around the pipe at each end to prevent the molten iron from burning onto it.

The pattern was treated in a similar manner, each half being grooved its full length for a close fit on a section of pipe. In making up the drag half of the mold a match board grooved to hold one side of the pipe was used. The pipes are long enough to extend several inches beyond the flasks, and notches on the

ends provided a means of securing accurate register when setting the core. On account of the fact that a wooden flask quickly burns loose around all edges, a cast-iron bracket was prepared to fit inside each end of the flask, these brackets being notched to match the notches in the pipes and providing the means of registering. These brackets are a permanent feature of the flasks and are placed on both the cope and the drag.

Another method of accurate core setting has been developed by a concern manufacturing small steam engines used for driving winches and cable hoists. The quantity of identical units was large and considerable time was consumed in boring out the piston head and fitting the rod in place. For this reason it was decided to cast the rod into the head, thereby not only saving time but also insuring a head that would not work loose on the rod.

To have the head in perfect balance without finishing all over it was necessary to set the rod in such a manner that there should be no opportunity for it to shift.

A core had previously been used to inclose a portion of the casting which was provided with the hole *A*, Fig. 3, the exact size of the rod, and the iron setting frame *B* made to guide the core into position in the mold.

The mold was made in a manner similar to that for the tank, being provided with a match board for the pattern that held the latter in a certain position in relation to a finished rim of the flask. The core is set by using the frame *B* to guide it into the same position relative to the finished edge of the flask as that occupied by the pattern.

The piston rod is inserted in the core and the cope rammed about it and around the core which covers the pattern cavity below. During the ramming, and later during the pouring of the casting, the piston rod is accurately held in a vertical position by the frame *C* which is bored out on its lower rim to fit over the finished rim *D* on the upper edge of the cope flask. The center is bored to a close fit on the piston rod. The amount of preparation necessary to carry through this piston-head casting operation was inconsiderable and the results obtained were remarkably accurate.

The Difference Between Army and Navy

SPECIAL CORRESPONDENCE

The noticeable difference in the attitude of the American people toward the army and the navy has prompted us to secure the following explanation from a writer who is familiar with both. This is not intended as a criticism but rather as an explanation of such differences as may exist.

THE writer believes that there is a psychological difference between officers of the army and the navy, or perhaps it were better to say a difference in the psychological training in the two branches—which would account for the various differences between the methods followed by the navy and the methods followed by the army in meeting the emergency requirements of the war. As I think it over there are a number of ways of explaining this difference, which is perfectly evident to all, and one explanation of it may be now put forth. There are other and may be better ones, but this one has in it certain elements of interest, and it is a good point to start from in watching the development of both services during the war.

The navy seemed to be ready. It had a good many ships which it immediately put into service—very quickly and apparently very effectively. It seemed to have plenty of reserve ordnance and ammunition and plenty of capacity for increasing its reserves. It had very little aircraft at the beginning, but there is abundant evidence that it has a plenty now, the most conclusive perhaps being the prominent absence of criticism of the navy in the recently much discussed aircraft scandal.

The army was slow in starting to build rifles; it thought it had to have a new design. The army could not use any type of machine gun in production at the time war broke out, but must needs experiment and consider at great length before starting to build any. And so it went with the great majority of the war material, as well as questions of personnel, organization, etc.

The navy, however, seemed immediately to know what is wanted in the way of submarine chasers, destroyers, machine guns, ordnance, aircraft, etc. It began to take material at the time in production and simultaneously began the development of better material. Why was this?

There is an officer in the navy, who is now holding a very honorable position both in title and in actuality, in the confidence and the esteem of the United States and our allies. A thumbnail sketch of what he did for the navy would at once explain his present prominence and perhaps would throw light on the navy's methods of thought and action.

Vice Admiral William F. Sims, U.S.N., was at one time watch officer on a battleship in the Far East. But he was not so far away that he could not make his influence felt. By conversation and in official correspondence he pointed out the inefficient methods of target practice in the navy at that time, and finally after appealing direct to President Roosevelt he was given an opportunity to stand or fall on his theories. It was through him then that there was introduced into the navy a regular competitive system of target practice under uniform and standardized conditions for all classes of vessels in all parts of the world.

Prior to his standardized target practice there was no definite way of telling whether the guns hit their target or not; but by his method it could be told with certainty when hits were scored, and gun pointers, gun crews and even ships were judged by the percentage of actual hits made on the target screen.

The navy was thoroughly awakened. Its officers found that gun crews were not skillfully selected or properly trained, and that as soon as the crews were trained there opened up a wide vista of improvements in guns, ammunition and accessories of which no one had dreamed. There began a most intensive study of navy material, which led to an entirely new development of material, including improvements in the ships. The greatest improvement appeared in the personnel of the navy officers and men, and this of course was to be expected and was necessary because no matter how good any material or the method of using it, it is the officers who direct the men and determine the effectiveness of the material.

Officers turned more intently to the study of the lives, campaigns and teachings of the great soldiers and fighting seamen of the past. This was not merely the study of tactics in action but the study of strategy, and more important still the study of organization and training which made possible the use of subtle strategy.

Where the Difference Developed

And here, in the opinion of the writer, is where one of the great differences between the officers of the army and the navy is developed. Officers of the navy in their study, in their target practice, in their work, were made to think for themselves. When a ship at target practice starts down the range, even junior officers find themselves loaded with their responsibility, not broad and undefined, but of close definition, and every officer must think and act on his own initiative and responsibility in such a way as to get results which he knows are going to be measured. The further up the ladder the officer goes in years and development the more his responsibilities and the greater the necessity for quick thinking and prompt action. Nearly everything in his training and experience points to the value of time. This spirit spread to the shore establishment, being taken thither by seagoing officers on shore duty, and it was developed also in nonseagoing officers by their own observation and thought.

The writer does not wish to be understood as being of the opinion that the army officers were not receiving training. They were, although not under such closely regulated competitive conditions as were found in the navy, and therefore not so intensive and thorough. Yet as between the officers in the regular army and the officers in the regular navy there is a difference, which the writer believes can be partially accounted for by the foregoing explanation.

Another great advantage enjoyed by the navy was that when the war hit us the degree of expansion in the navy was less. The dilution of navy officers was not as great as that which obtained in the army. It is true that the navy is several times as large now as it was before the war, but the officers of the regular navy are running the navy and the many young men and fewer older ones who have gone into the navy from civil life are almost without exception in subordinate positions, receiving the training which regular officers themselves enjoyed.

The army, however, in the beginning of the war was hardly sufficient to fill the Yale Bowl, yet it has expanded to a force that is reckoned by millions. In the effort to get men of mature years and experience to fill the responsible positions created by necessity the army turned to civil life. Civilians with successful business careers, many with a generous contempt for Government red tape and imbued with the notion of showing antiquated and obsolescent Government officials how the war should be won, stepped blindly into troubles of which they had not the remotest anticipation.

Not only were they unaware of the value of time in the military world but they lacked military training; they lacked experience with organizations as large as that even of the old army, to say nothing of the tremendous size of the Government's organization. The reason they had had no red tape was that their businesses, even though large, were relatively small. Meeting problems unknown to them they hesitated; wanting further information they stopped to experiment; cocksure of their ability they declined advice; unaware of the difficulties they assumed that there were none. Probably the underlying reason of the failure of the aircraft program was the belief of the freshly made army officers that the construction of airplanes and airplane motors was a simple production proposition of which any automobile manufacturer could make easy work.

It would be easy indeed to pursue this line of thought to great length, but the presentation of the idea is sufficient. Summed up the idea is that the army was to an enormously greater extent diluted by civilians ignorant of things military, inexperienced in enormous organization and devoid of military training. Being in such large numbers they necessarily in the early days dominated the situation. The regular officers, had there been enough of them, would likely have done nearly as well as the navy, although it is probable that special conditions obtaining in the navy for the last 15 years gave the naval officers a great advantage both in point of actual preparedness at the time the war came and of enlarging their organization to carry on the war work.

Women for Employment Managers

The Case School of Applied Science, Cleveland, Ohio, has started the first course in the United States to train women for war work as employment managers in munition plants and other factories doing war-essential work. The Government is encouraging the employment of women in various industries to take the places of men called to the colors, the purpose being to fit women to take charge of the employment of female labor. The course is under the direction of the United States Ordnance Department, through the committee on Labor Relation of the Cleveland Chamber of Commerce, and Miss Mildred Chadsey of Western Reserve University is directing the work. Cleveland was selected as a suitable place for carrying on this training, because of the large number of plants engaged in various kinds of munition work in that city. The Cleveland manufacturers are heartily coöperating and have willingly taken the students in their shops in which they will gain the practical experience desired. The plants in which they are employed during the daytime include the American Multigraph Co., Cleveland Hardware Co., Cleveland Metal Products Co., Hydraulic Pressed Steel Co., Osborn Manufacturing Co., Standard Parts Co., Standard Tool Co., Warner & Swasey Co., Kirk-Latty Manufacturing Co. and the Steel Products Co.

SIDELIGHTS

EDITED BY E. C. PORTER

The new United States rifle is proving its worth in rapid-fire tests. The War Department recently announced several records made with the new rifle by four members of the 149th Infantry at Camp Shelby, Hattiesburg, Miss. The scores made on the 100-yard rapid-fire range, firing 10 shots a minute at a silhouette target, showed that out of a total of 771 shots 762 were hits and only 9 were misses.

* * *

A metal suitable for the very finest forms of cutlery has been developed from combining iron, chromium and cobalt, according to an announcement made by Prof. W. L. Goodwin of Queens University, Kingston, Ontario. Consul F. S. S. Johnson, who is at Kingston, reports that the new metal is easy to work and is shortly to be put on the market in commercial quantities. Professor Goodwin is chairman of the Canadian Section of the Society of Chemical Industry, which organization, in conjunction with Canadian chemists and chemical engineers, is working toward getting a higher degree of extraction of useful substances from ores and finding new uses for waste products.

* * *

Four new flying fields in the neighborhood of Hazelhurst Field, Mineola, L. I., and under the command of Major C. K. Reinhart, J. M. A., Department of Military Aeronautics, have been named Lufbery, Mitchel, Damm and Brindley fields. The new field at Wantagh, L. I., has been named Lufbery Field, in memory of Major Raoul Lufbery, who was killed in an aerial combat in Lorraine, France, May 19, 1918. Field No. 2, at Mineola, L. I., is now known as Mitchel Field. It is named in honor of Major John Purroy Mitchel, who met his death in an accident at Gerstner Field, July 6, 1918. The field near Babylon, L. I., is named Henry J. Damm Field, in memory of the late Lieut. Col. Henry J. Damm, killed in an aviation accident at Moraine City, near Dayton, Ohio, May 2, 1918. The field at Commack, L. I., is designated as Brindley Field in memory of the late Major Oscar A. Brindley, who was also killed at Moraine City, Ohio, May 2, 1918.

* * *

Under the direction of the Construction Division of the Army a 40-bed hospital ward was recently erected and made ready for occupancy in 10 hr. and 38 min. The building is an addition to the hospital establishment of General Hospital No. 10, known as the Fox Hills Clearing Hospital, at Staten Island, N. Y. The building is a one-story frame structure, with a convalescing porch, and has in addition to the ward a diet kitchen, surgical dressing room, linen room, bath and ward-officers' toilets. It is 156 ft. long by 24 ft. wide. The porch is 10½ ft. wide and runs the length of one side of the building. The work was begun at 7 o'clock in the morning and at 5.38 in the afternoon the last nail was driven. The finished building was fully wired, the lights ready to be switched on, and water running in the pipes.

Many well-intentioned individuals have offered to take crippled soldiers into their service as watchmen, messengers and positions of similar character. While the spirit in which these offers are made is appreciated they conflict with the policy of the Medical Department of the army. From the time a wounded soldier is taken to the field hospital he is encouraged to understand that the seriousness of his wounds will not render him worthless for useful work. The work of reconstructing him both physically and mentally is carried on simultaneously. At the present time there are many soldiers in the army hospitals in this country who have been crippled in the course of duty. In many cases these men are receiving the preliminary training which will be finished by civil boards authorized to continue the work begun by the Surgeon General. The War Department hopes that business men in general will accept these trained men on an equal footing with men who have not been crippled. These men will receive a training which will make them competent in the trade or profession which they elect to follow.

* * *

Of all the countries on the west coast of South America, Chile offers the best opportunity for the immediate sale of electric goods. Germany dominated the market before the war, but according to a report just issued by the Bureau of Foreign and Domestic Commerce, Department of Commerce, American goods have recently made big gains. Chile is a country where the natural resources and the will of the people make for progressive development along industrial and manufacturing lines, which means a steadily growing demand for power. The author of the Government's report asserts that this should and will be furnished by harnessing the many waterfalls of the Cordillera of the Andes to electric generators and sending the current to all parts of the central section of the republic. The report analyzes every phase of business in Chile and Bolivia.

* * *

The Fabricated Ship Corporation, Milwaukee, has been organized with a capital stock of $600,000, by a combination of interests identified with the Newton and Coddington Engineering Companies of Milwaukee, to establish and engage in the construction of fabricated-steel ships for the Emergency Fleet Corporation. This will be the first steel shipbuilding plant at the port of Milwaukee. Much of the machinery and equipment has already been purchased, and it is expected that the first keel will be laid before Oct. 1. The new corporation has completed its organization as follows: Managing directors, Ralph E. Newton, general executive and engineering supervision; Samuel C. Coddington, treasurer and supervision of fabrication; George C. Newton, in charge of mechanical plant and equipment of yards and ship construction; Thomas J. Baker, in charge of shipyard construction and outfitting. Alfred L. Newton is chief purchasing officer and Julius Thielacker is superintendent of steel erection.

Machining Pistons, Flywheels and Cylinders of Gasoline Engines

By M. E. HOAG

A large battery of Potter & Johnson automatics is here described where they are used on work of an unusual nature for these machines. In many cases the special fixtures and tooling employed are sure to be of interest.

IT WOULD seem that the different ways of machining gas-engine pistons would be limited, but in the shop of the Root & Van Dervoort Engineering Co. some new and interesting tools have been developed. For instance the method of rough drilling shown in Fig. 1 is something of a departure from the usual.

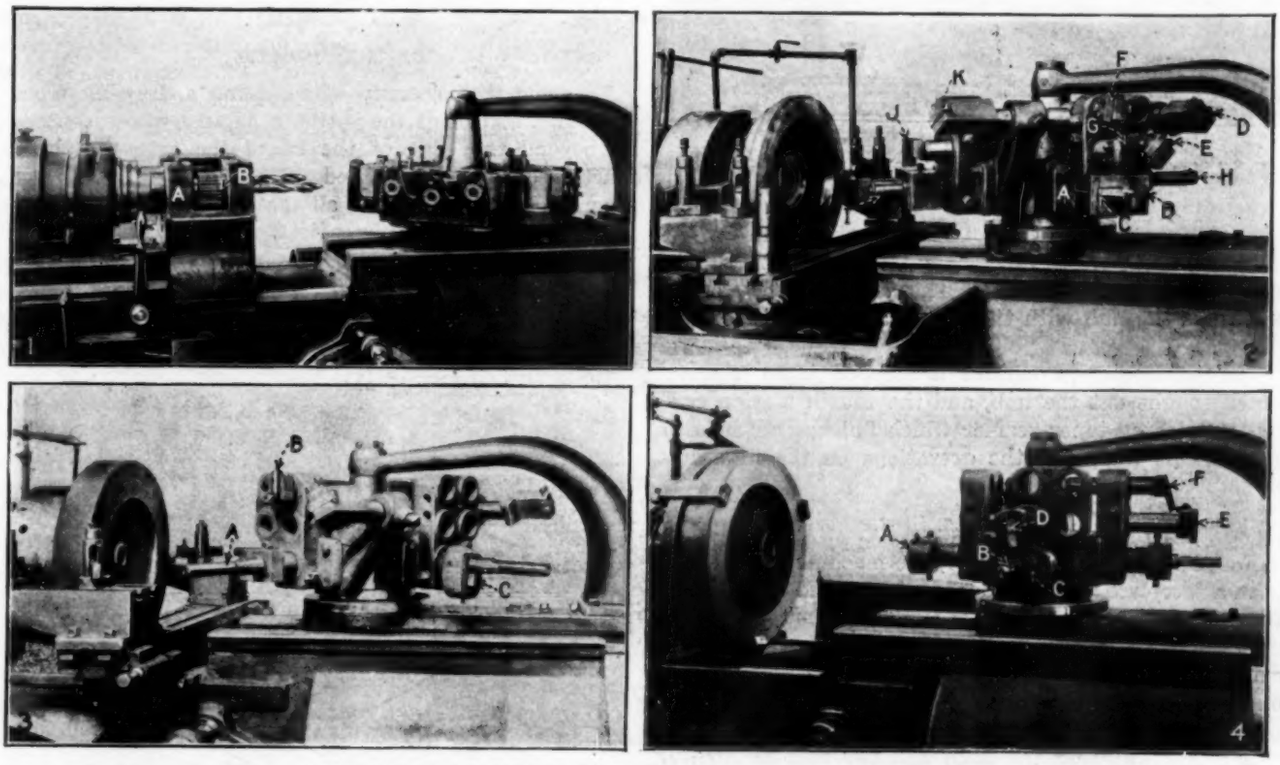
The geared head shown at *A* rests on and is gibbed securely to the bed of the machine. A gear on the machine spindle engages three gears in the head, so arranged that they are properly spaced to align with the bushings in the fixture which holds the pistons.

These gears and their shafts are integral and have adjusting collars for taking up end play. The front ends are bored to take taper-shank drills and have oblong openings, as seen at *B*, for drifting out the drills. The illustration shows this head with the front half of the protective cover removed. The rough pistons are held and located in the jig mounted on the tool turret; V blocks at the back of each section and two setscrews for each piston locate and hold them firmly during the drilling operation.

Hardened and ground plates and pins on the bottom of each piston location give the proper height spacing and also locate the wristpin-hole bosses true with the drills, so that the holes come as nearly central with the bosses as it is practical to get them. The rest of the operations on the pistons are handled in much the same manner as in other shops.

In the Root & Van Dervoort shops the machining of flywheels up to 40 in. in diameter is done successfully on Potter & Johnson automatics, and owing to the number of operations performed on one setup the operator is enabled to care for several machines.

The flywheel shown in Fig. 2 is finished on this setup, the first station of which is shown at *A*. The cored hole in the wheel is rough drilled with the core drill *B* and the recess is roughed out with the broad tool *C*. At the same time the cross-slide is operating two tools which rough-face both sides of the rim. The tool *D* rough-turns the outside diameter; *E* turns the inside diameter of the rim; *F* chamfers the corner, and *G* faces the hub rim outside of the central recess. The second tool station bores the hub with the boring tool *H*; the third station reams the hub. Station 4 is shown just coming to operating position and the rear cross-slide tools coming forward to finish the sides of the rim.



FIGS. 1 TO 4. DRILLING AND TURRET MACHINE OPERATIONS

Fig. 1—Jig for drilling gas-engine pistons. Fig. 2—Operations on one type of flywheel. Fig. 3—First operations on another type of flywheel. Fig. 4—Final operations on same flywheel

The turret tools are guided and supported by the bushing *I* which just fits the reamed hole in the hub and is free to turn on a hardened and ground steel arbor held in the tool block, as shown. This block also carries a broad tool which sizes and faces the recess in the hub.

The tool *J* faces the hub rim, *K* turns the outside diameter of the wheel, and a tool at the back finish-bores the inside of the ring; all of these tools being supported and operating at the same time insures trueness and concentricity of all machined surfaces.

Another flywheel of a different type is finished with two setups, as shown in Figs. 3 and 4. This wheel is chucked, and with the first tool station rough-turned,

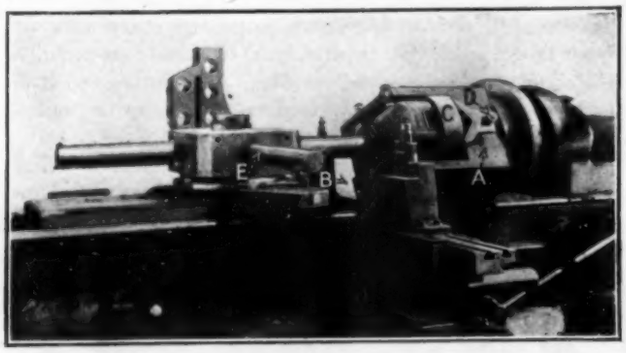


FIG. 5. MACHINING GASOLINE-ENGINE CYLINDERS

rough-faced on both sides and rough-bored, the boring bar being supported by the pilot *A* entering a bushing in the machine spindle. The inside corner of the rim is also beveled by the tool *B*. The second station bores and faces the hub with the tool *C* and finish-turns the rim.

The third station carries a stepped taper reamer which roughs out the hub, and the fourth station carries a finishing taper reamer which finishes the hole to gage. This completes the operations on the first machine.

A Faceplate Setup

For the second setup, Fig. 4, the machine is equipped with a faceplate and a hardened and ground taper arbor for the work, with a hole through its center to support the pilots on stations 2 and 3. The first station *A* carries a broad, serrated tool for breaking up the scale on the face of the hub. The second station carries a pilot *B* which enters the hole in the arbor, and a facing tool *C* for finishing the hub, and the turning tool *D* which turns the hub. Station 3 also carries a pilot, and the turning tool *E* and the chamfering tool *F* which finish-turns the hub to size and then chamfers the inside of the rim.

By referring to the illustration it will be noticed that the wheel is held against the faceplate by three clamps. There were several reasons for doing this. First, the wheel was so large it could not be chucked and swing over the bed of the machine. Second, chucking would throw the wheel off center unless great care was used in indicating it, whereas the taper arbor takes care of this absolutely. Third, even if the hole was chucked true, the rim of the wheel would also have to be trued up or the faces would not run true. The clamps bind the finished face of the wheel firmly against the faceplate, which is always kept true.

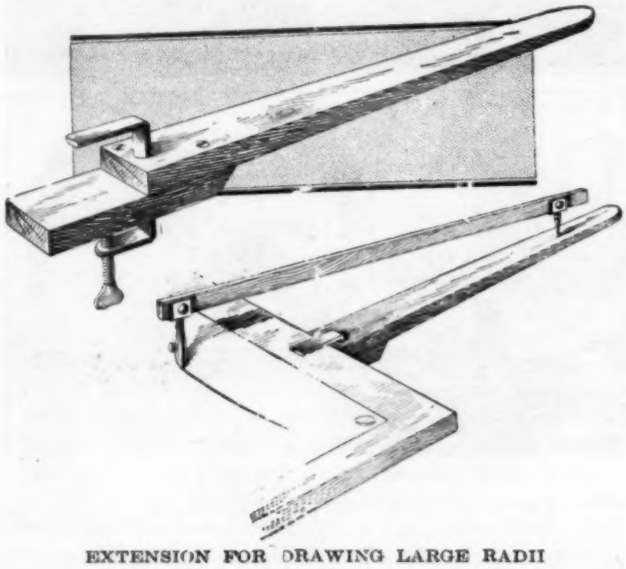
Besides automobile and tractor engines the Root & Van Dervoort Engineering Co. manufactures a large number of stationary gasoline engines of the single-cylinder type. Some of the smaller cylinders for these engines are machined on Potter & Johnson automatics, as shown in Fig. 5. The cylinder is held in the box jig or chuck *A*, suitable locating and binding screws being used to hold it. The neck of the cylinder casting is located by the radius block *B*. The yoke swings forward out of the way to permit placing the casting, and is then swung back and clamped down onto the cylinder by the swinging bolt and nuts at *D*.

The tools in the cross-slide rough and finish face the head of the cylinder; the boring bars rough-bore, finish-bore and recess the cylinder bore, and the double tools in *E* turn the outside of the head. Another tool carried in the machine head faces and chamfers the open end of the cylinder and completes the operations.

Extension for Use in Drawing Large Radii

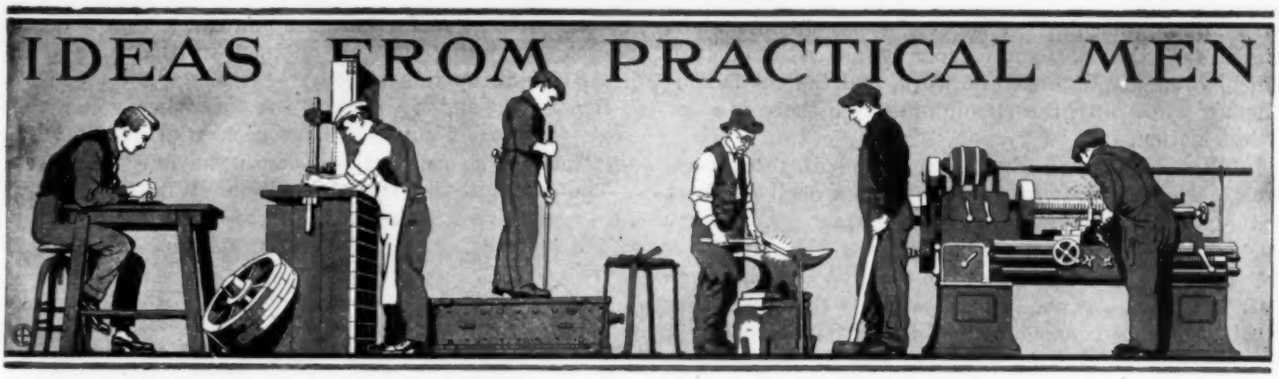
By E. Schwartz

To avoid the necessity of removing a drawing from the board to permit the scribing of arcs whose centers lie beyond the edge of the board the extension here illustrated has been devised. Two pieces of wood and a small clamp casting are all that is required. A suitable width for both pieces is 2 in. The upper piece, which can be made 12 in. long, should be a trifle less



EXTENSION FOR DRAWING LARGE RADII

in thickness than the drawing board at the base to enable the clamp to grip the board. Both edges and the under side of the extension should taper toward the outer end in order to lighten it and give it a better appearance. A hole is bored through both pieces, after they are fastened together for the clamp to slide in easily. It will be seen that nothing projects above the drawing surface except the upper part of the clamp and that no difficulty will be experienced in drawing radius lines with trammel points or beam compass.



Shop and Drafting Room Kinks

By Donald A. Baker

A clever little time-saving kink which I ran across recently in a small-shop drawing room was the leaving out of the inch marks (") until the drawing was ready for the checker; then instead of the checker defacing the drawing with a red or blue pencil as is the common custom he simply inserts the inch marks where they belong, and they thus serve a double purpose—as a check mark in the drawing room and as the usual inch mark in the shop.

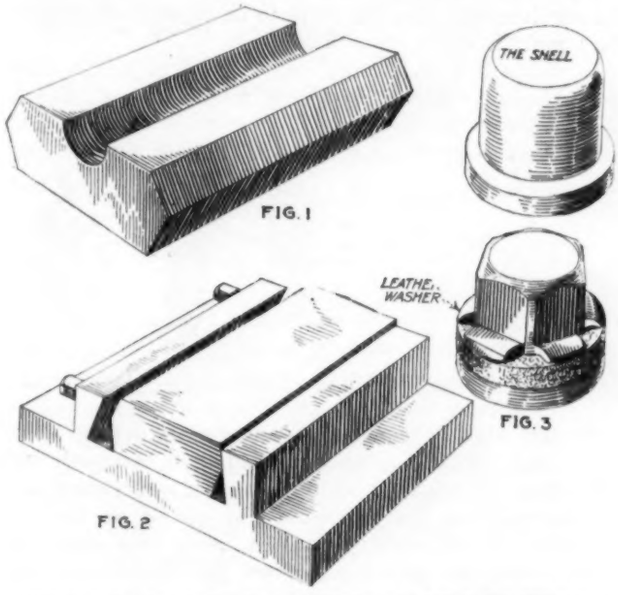
Another kink which was told to me by the manager of a large drafting-supply house, who by the way, is an old-time practical man himself, is a scheme for speeding up the preliminary work of laying out and designing.

Cross-section paper laid out in one-eighth squares is difficult to obtain in any but small sizes, while the price of special sizes made to order is prohibitive. As cross-section paper offers a convenient means of making rapid layouts to scale the following method was adopted, which is an improvement over the regular cross-section paper as well as being cheaper.

A piece of cloth-mounted paper as large as the drawing board will take is first carefully stretched on the drawing board. This is then laid out in one-eighth squares over its whole surface, the ¼-, ½- and 1-in. cross-lines being heavier or dotted to distinguish them from the others. When the inking is completed we have what might be called a master cross-section sheet. This is left in place on the board, while a sheet of vellum or other transparent paper is fastened over it and on this latter the design is worked up. When completed we have a finished drawing without the defacement of the cross-section lines. If a soft pencil has been used and enough pressure exerted to get deep black lines we can now get excellent blueprints from our drawing.

The old saying, "Necessity is the mother of invention," is always in evidence in the small shop, and some of the methods there employed might well be copied by larger shops that are sometimes considered more advanced.

A good illustration is the job here described. A Canadian government contract for parts of an ammunition truck called for many thousand drop-forged parts like Fig. 1 to be finished on the two flat surfaces and the radius or half bearing. The contract price of these was something over 30c. apiece for the machine work alone. One shop which took a large number carried out the operations in the following manner. It first milled the large, flat side, then turned the piece over and milled the other side, using a radius cutter and two slab mills mounted on the same arbor. I have put this job up to a number of good mechanics and they all agree that this would be their method of doing the work. However, the shop which tried it did not make enough out of the job, so they were later glad enough to sublet it at almost the same price that they were getting. The small shop which took the job used the following method and produced the pieces at a cost of about 4½c. each: First a fixture like Fig. 2 was made



FIGS. 1 TO 3. TWO DIFFERENT CLASSES OF WORK
Fig. 1—The piece to be machined. Fig. 2—Fixture for holding the piece in the lathe. Fig. 3—An unusual press job.

and fitted to the faceplate of a lathe. The work was clamped in the fixture by tightening the setscrews shown, and one side was faced, using the cross-slide of the lathe and an ordinary tool in the toolpost. The piece was then reversed and a like cut taken across the other face, this completing the two sides with the exception of the half bearings. A fixture somewhat similar to those described was made, into which two of the pieces could be placed face to face; a drill was run through followed by a reamer, completing the half bearing in both pieces in the same operation.

This method put the work on the simplest and cheapest machines in the shop, and the whole job was done by an inexperienced boy, all of the different cuts being taken in much less time than they could have been done

on a milling machine. It does not pay to lose sight of the fact that we can frequently use a lathe upon which to do shaping-machine work, and the cut is continuous, while with the shaping-machine there is a lot of lost motion.

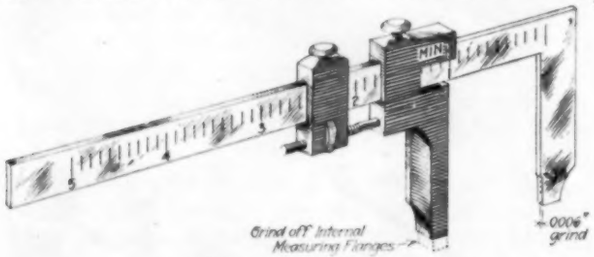
In Fig. 3 is shown a rather odd job of sheet-metal work. This consists of a heavy drawn shell of sheet metal on which it was required to fasten a leather washer. It was also necessary to have the outside of the shell hexagon in shape to take a wrench. The leather washer was put in place, and the shell put under a hollow hexagon punch. When the latter descended it sheared the metal from the diameter of the shell in the form of a curled shaving which turned down around the washer, holding it securely. I was unable to learn the purpose for which these pieces were used, but I give it as an interesting and odd piece of press work in the hope that it may suggest something to my fellow workers.

Adjustable Limit Gage for Gaging Small Lots of Various Size

By W. P. Lotz

The sketch shows an adjustable limit gage to meet the requirement when the work to be gaged is of various sizes and in small quantities.

A standard 5-in. vernier caliper was used for making this gage, which takes care of a tolerance of ±0.003.



ADJUSTABLE LIMIT GAGE

First the internal measuring flanges were ground away and a step 0.006 in. deep was ground in the outer leg. Alongside of this step a note (0.006) was etched and the abbreviation for minimum was etched on the jaw alongside of the index line. In using this gage the vernier was set to the minimum figure and the step took care of the maximum.

Setting Angle for Fluting Taper Reamers

By Boyd E. Keifer

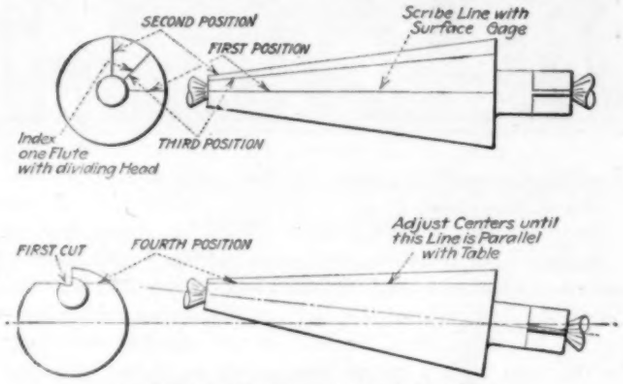
A very handy shop kink is shown in the sketch for the angular setting of milling-machine centers to insure even width of the land when fluting taper reamers.

Tables in various handbooks give the values of these angles for angular cutters, but only in increments of 5-deg. included angle of the piece to be cut, while in the case of taper reamers this angle is more than likely to fall between the given settings.

Again, if the angle of the fluting cutter is changed the set angle must also be changed, whereas with my method the setting is independent of the angle of the fluting cutter, and furthermore one can set up a taper reamer or cutter by this method in the time that he is looking up the table.

By the cut-and-try method the toolmaker will make from four to six cuts (two for each trial) while with this method he can cut full depth the first time.

The sketch needs little explanation. With the centers in parallel position and a surface gage set to the



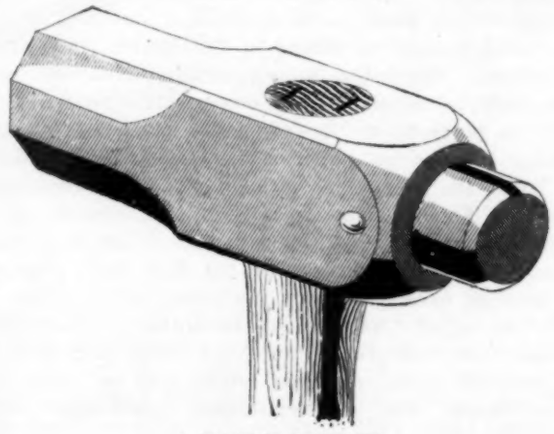
METHOD OF SETTING THE ANGLE

center height draw a line on the surface of the reamer to be cut (first position). Turn the dividing head one-quarter turn until this line is at the top (second position); then index back one tooth to third position. Now raise the dead center until this line is parallel with the surface of the table, testing for parallelism with the surface gage. It will readily be seen that this line represents the edge of the tooth next to the first one to be cut and that it will parallel the path of the fluting cutter.

Combined Hard and Soft Hammer

By Joseph K. Long

The sketch shows a handy hammer to have around the shop, as it combines in one tool a hard and a soft hammer of suitable weight for driving keys or assembling



A HANDY HAMMER

or disassembling other machine parts that are machined to a drive fit.

The hammer head is a steel casting with one end cored out to receive the copper plug which is forced in and further secured by the rivet passing through it and the casting.

The hammer weighs about five pounds.

From Major-General C. C. Williams

Chief of Ordnance, U. S. A.

I am asked by the Director of Arsenals to convey to the army of workers in the 11 Government arsenals something of the thoughts that have long been in my mind as to the opportunity and obligation of the arsenal forces in the critical situation that faces the country.

With the arsenals I feel that the problem is largely psychological. Therefore, what is said to you, what you yourselves are saying to each other and what you are thinking, is of real importance.

You have exceptional equipment for your work. You enjoy good conditions generally in comparison with the munition industry that has been built up by private enterprise since our entrance into the war. But more than all of this you have technique, the "know how" of the French. It was lack of technique, lack of knowledge of methods and the details of shop practice, unfamiliarity with the highly specialized business of manufacturing munitions that most seriously handicapped our manufacturers in this prodigious undertaking.

In time of peace the arsenals developed this technique because they were in a sense experimental laboratories wherein were developed types of weapons and where the Government was constantly striving for perfection. Today our goal is a very different one. We want the best designs, the best material from an engineering standpoint, that can be obtained, and I see by the press dispatches from Amsterdam that the correspondent of the Berlin *Vorwaerts* has quite recently credited our troops in France with having "excellent equipment throughout." But while we want this excellence of material we cannot in this critical situation seek perfection in design at the cost of production.

Our imperative duty is to produce. It is especially urgent that we strive to obtain the utmost production in the ordnance program. The Chief of Staff has repeatedly accelerated the transport of troops to France. Therefore the obligation of the Ordnance Department has repeatedly been made heavier. It is a burden which you men and women in the arsenals chiefly must shoulder, but no matter how heavy the task becomes we cannot falter; we cannot be satisfied with less than success, and we must individually contribute whatever is necessary to achieve success. This we must do because we know that it is the supply of this ordnance material that is the only worthwhile life insurance that we in this country can provide for our men overseas. It is the one guarantee of victory. With the successful support of the army of munition workers our oversea army will be invincible. Without it it cannot win.

To return to the special problem of the arsenals. I have said that you possess the great potential advantage of technique. You know how to do this job. You have done it well—I might almost say, superlatively well—for years and years. But in those years of peace you did not work with the idea of quantity production in your mind. Now you must do your work with that idea absorbing your whole interest. You must become quantity-production enthusiasts. You must completely change your point of view from the one developed in your work through many years before the war.

Sometimes technique interferes with quantity production. Sometimes a man knows how to do a job so well and takes so much pride in doing it perfectly that he overlooks the necessity for doing it quickly. Good work is demanded, but it must be good work with speed. Let me say that I have followed some of the efforts of the arsenal forces to speed up production with the greatest interest. Every success scored in that direction, every time Watervliet succeeds in breaking a production record, that accomplishment I want you to know is registered here in Washington as indeed it is registered and with much more effectiveness east of the Marne.

Editorial

What the Machine Tool Has Done To Warfare

IF SOME reincarnated warrior of A.D. 102 were to express his opinion of modern warfare he would no doubt remark "It has changed a bit since my time." It is hardly likely, however, that he would be acute enough to point to the machine tool as the fundamental reason.

The business of feeding an army is about the same today as it was in past centuries, and it is still true that armies travel upon their bellies; but the amount of food required to fill each individual fighting man is without doubt less today than in the days of the hairy prehistoric savage. Machine tools are not used in the commissary department.

The methods of administering an army have not changed materially. Discipline is maintained today by substantially the same means that were used in the days of our reincarnated friend of A.D. 102. Machine tools are not used in court-martials.

Soldiers of today march by companies as did the Romans; tunnel and dig as did the ancient Greeks; skirmish and take cover as did the Indians. Machine tools are not used in maneuvering an army.

Clothe our boys abroad in bear skins or blankets and they would without doubt give as glowing an account of themselves as they do in modern khaki.

Take from them the products of the machine tool and you immediately put the art of warfare back to the days of Hannibal.

Take the machine tool out of warfare and you take with it every rifle, machine gun, cannon and howitzer, shot and shell—you eliminate every modern means of transportation, every locomotive, steamship, airplane, tractor and truck. Modern warfare minus the machine tool equals ancient warfare.

Machine-tool productive capacity back of our valiant boys will win the war. Keep all of our machine tools busy!

Bringing the Small Shop Into the War

SMALL shops of the United States outnumber its large shops nearly 10 to 1. Individually the effectiveness of *a* small shop's equipment is hardly worth considering from the standpoint of its possible war value. Collectively *the* small shops of this country present a machine-tool capacity so great that it must not be overlooked.

Many of these small shops have built up through years of hard work highly specialized business which is not essential for winning the war, but which is essential to a well-balanced and healthfully developed peace-time national industry. Government intention is not of course to have these nonessential mechanical industries go to pot, but to have them apply themselves to essential work for the period of the war.

Is it out of place to suggest that if this is Government intention, Government agencies be provided to assist the small shop in so doing?

At present it takes a very large shop indeed to negotiate a contract directly with the Government. The War Department must naturally handle its enormous volume of business by wholesale methods.

There should be a Government "retail department," however, maintained particularly for the benefit of the small shop and for the purpose of utilizing the enormous aggregate of small-shop capacity through telling the owners of these small shops how and where they can secure essential work. It should not be left for the prime contractors in a few individual localities to undertake the mobilization of small shops in their vicinity.

A big total is obtained by adding a long column of small figues. Uncle Sam must not overlook the big aggregate of machine tools in his small shops. Keep all of our machine tools busy. Remember that modern warfare, minus the machine tool, equals ancient warfare.

Front Lines and Back Lines

WE ARE going to put enough men in the front line to make the downfall of Kaiserism a matter of months instead of years, and so the new draft-age limits are from 18 to 45.

Naturally this act has stirred industry to its very foundations, since substantially the entire personnel of industry is now within the draft.

It is harder now to keep the wheels turning than it was in prewar days. It requires more energy, enthusiasm, physical endurance and persistence than it did when the industrial problems to be met were to be solved by past experience. The mechanical industries of today cannot run with weak mainsprings.

The new draft act is of course intended as selective. The danger to industry does not lie in the act itself but in erroneous interpretation of this act by local boards, the members of which are not always students of economics.

An illustration of this which comes to mind is the case of a civilian technician whose age came within the previous draft limits and whose particular qualifications and experience made him of unusual value in technical work in one of the Government departments. In spite of the fact that the head of this Government department forwarded to this man's local and district board affidavits testifying to the essentialness of this man to that department; in spite of the fact that the Secretary of War twice indicated by signature his approval of these requests for the deferred classification of this man, he is now shouldering a gun.

You cannot blame the draft boards for taking essential men from your vital industry when they fail

Comment

to recognize the essentialness of the man and the vitalness of the industry.

It is *your* duty to set before these local boards the mathematical fact that modern warfare minus the machine tool equals ancient warfare. Keep all of our machine tools busy!

Work or Fight

ECONOMIC laws cannot be as lightly disobeyed as man-made ones often are. The same economic law which in war time compels the nonessential industry to become essential or close its doors will inevitably force the worker who can work, but does not, to join the Army.

There is nothing whatever unfair about this work or fight proposal. It does not mean that labor is in danger of oppression, for the rights of labor are more amply safeguarded today in America than ever before. It simply means that no American will be permitted to stand idly by and view the coming of the Kaiser without either throwing a brick at him himself or making one for somebody else to throw.

Every man whose job it is to run a machine tool and who does not or will not is helping the Kaiser.

Uncle Sam's Universities

IF THE draft-age-extension act were to be applied without qualification, every university and technical school in this country would close its doors, inasmuch as very few students are under 18 or have dependents, and most of them are physically fit.

Uncle Sam has provided against an unfortunate condition of this kind which would have the effect of disorganizing these important centers of learning and dispersing what is now left of rather meager instructing forces.

This year every man who goes to college will be an enlisted man in the United States Army. He will go to his classrooms in uniform, live in barracks or dormitories under Government subsistence, receive regular pay as a private, and be drilled in the manly art of home defense during those hours when he is not being mentally fitted for a technical expert. Boys of 20 will stay in school three months; those of 19, six months and those of 18, one year. If they show promise of making good officers or technicians they will be detailed for further instruction.

Men at training detachments between 18 and 20 who demonstrate their ability to receive training at one of Uncle Sam's universities will get it.

Needless to say technical and engineering instruction will predominate. There will be very little Latin and Greek taught by Uncle Sam at this time. Without doubt this will have a decided effect on the nature of postwar education.

Abolishing Unnecessary Noises

A "DAMPHOOL" with a hammer can make considerable noise and attract a remarkable amount of attention by bringing said hammer down smartly and repeatedly on the largest tin boiler he can find. Such a man is always sure of his audience.

The latest "engineer of standing" to volunteer his services to the public is Mr. Frederick Upham Adams, erstwhile smoke inspector of the city of Chicago and author of "The Kidnapped Millionaires" and other fiction. Mr. Adams very cleverly analyzes the reasons for our not having already whipped the Kaiser and comes to the conclusion that it is because of the "pernicious activities" of the corps of official draftsmen and experimental experts who "spelled calamity in nearly every field of war-material production." He further states that the famous French "75" field gun when brought to this country fell into the hands of these presumed artillery experts, who lost six months in trying to improve it.

The writing of light fiction has undoubtedly given Mr. Adams the power of imagination which is displayed in such statements as the above. No improvements whatever have been attempted by our Ordnance Department in the case of the French "75." The "pernicious draftsmen" on whom he blames the present state of the war are almost without exception men who since the war have entered Government service, coming from *your* plants either on their own initiative or being contributed by you in response to Government appeal.

The "pernicious technical experts," ninety-nine out of a hundred of them, are your former associates in the engineering and mechanical field who have entered the service since the war. You of course know better than to put credence in criticism of this kind, but the general public does not, and it listens to the noise of the hammer on the boiler in undisguised wonder.

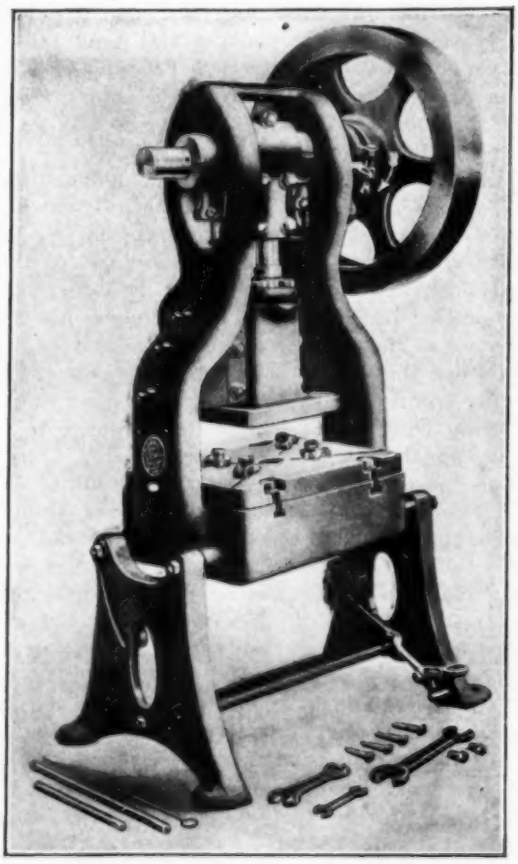
This sort of knocking, while it attracts its audience, may dent the boiler, but certainly it will not improve it. Criticism that is manifestly destructive and without the least semblance of constructiveness should be classed during the war time as an unnecessary noise. Let's abolish it.

John H. Van Deventer

This department is open to all new equipment of interest to shop owners. Photographs and data should be addressed to Editorial Department, "American Machinist"

Ferracute Presses

The illustration shows the third size of a series of six single-action power presses recently redesigned by the Ferracute Machine Co., Bridgeton, N. J. These machines are adapted for cutting and forming sheet-metal work of large area, being particularly suitable for blanking and stamping such parts as coal-hod sections, petroleum-can bodies, metallic shingles, etc. The frame is a single casting and the arched columns are solid, while the ram has a wide flange to adapt it for large upper dies. It is provided with a pin clutch and the shaft boxes are so arranged that the shaft may easily be removed or the bearings adjusted. The front of the bed is pivoted to the legs, enabling the press to be inclined if this is desired, the dies remaining at approximately the same height from the floor, whether upright or inclined. All corners are well rounded and large fillets have been incorporated.

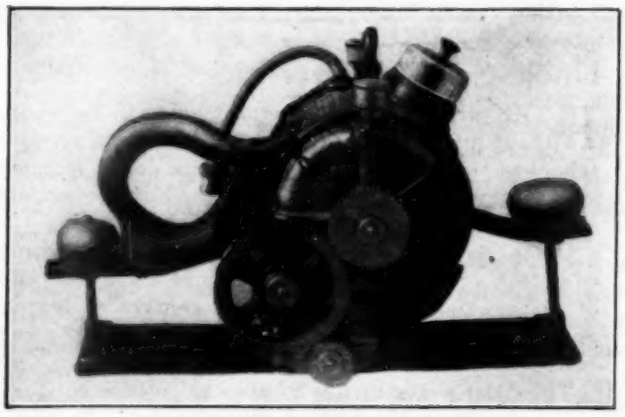


FERRACUTE E23 PUNCH PRESS

Size of bed, 25 in. right to left and 22 in. front to back; width between columns, 26 in.; diameter of flywheel, 35 in.; face of flywheel, 6 in.; weight of flywheel, 750 lb.; diameter of shaft bearings, 3½ in.; diameter of crank bearing, 4¼ in.; stroke, 2 in.; ram adjustment, 3 in.; height from bed to ram at top of stroke and adjustment, 10 in.; weight, 3900 lb.; ram pressure, 35 tons.

Universal Power Hand Plane

The motor-driven hand plane shown in the illustration has recently been placed on the market by the Universal Planer Co., Inc., 16 Exchange Pl., Room 6, New York City. While this device was designed primarily to obviate the work of the jack plane in planing the sides of wooden ships it is just as applicable in any case where large surfaces have to be smoothed over.

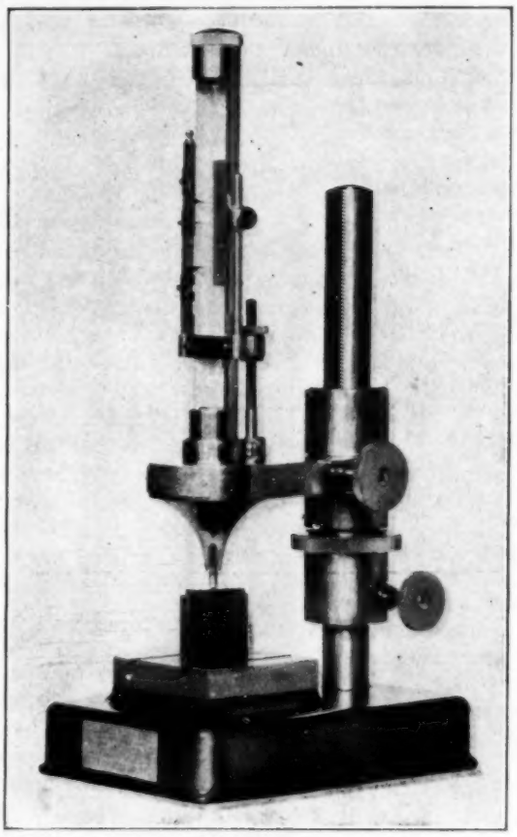


MOTOR-DRIVEN HAND PLANE

Rotary cutting blades are used, these being driven at a high speed by an electric motor incorporated in the machine. The thickness of the shavings taken is readily adjusted by means of setscrews, and provision is also made for bending the bottom surface of the plane so that either concave or convex work can be done. It is stated that the knives can be removed and replaced in less than 5 min. and that hard or soft wood can be cut with equal ease and at any direction to the grain. Motors are furnished to suit any current available, the connection being to the ordinary lamp socket, the maximum power required being 800 watts. The width of cut taken is 4 in., and it is claimed that one machine can do as much work as 20 men with jack planes.

Coats Precision Fluid Gage

The Coats Machinery Co., Land Title Building, Philadelphia, Penn., is now marketing the precision fluid gage shown in the illustration. The instrument is primarily a comparator and not an actual measuring machine. It operates on the fluid principle, any motion of the indicating pointer being transferred to a fluid diaphragm which has an area considerably greater than the area of the bore of the glass tube from which measurements are taken, this construction greatly magnifying measurements and permitting them to be determined with accuracy. The head carrying the diaphragm and glass tube slides on the column and is provided with independent coarse and fine adjustments. The rack and pinion shown is for coarse adjustment, while the indexed adjusting nut shown between the two thumbscrews is for fine adjustment. When this is in use the lower sleeve is locked on the column by means of the thumbscrew. The thread on the adjusting nut engaging the adjustable supporting arm is 40 pitch, left hand, and the thread engaging the sleeve which is clamped to the column is 40 pitch, right hand. This arrangement provides an effective pitch of 20 threads per inch, while the adjusting nut is provided with 50 divisions, making each equivalent to a movement of 0.001 in. One of the great advantages claimed for this instrument is the ample bearing surface on the arm containing the fluid container which slides on the 1-in. column. This bearing surface is above as well as below the supporting arm, this feature tending to prevent any spring. Both the supporting arm and the clamping nut move in unison up and down the column, sliding in the same keyway.



COATS PRECISION FLUID GAGE

Dimensions of base, 7½ in. front to back, 5½ in. wide; size of tool-steel anvil, 3 x 3 in.; weight without slanting base, 16 lb.; weight with slanting base, 18 lb.; height of column, 12 in.; total height of gage with testing head in upper position, 19½ in.; capacity, rounds from ¼ to 6½ in.; magnification, 800 to 1250 as desired; length of scale on indicating tube, 2 in.; diameter of column, 1 in.

In use the testing head is lowered sufficiently to almost touch the master pin, ball or gage, and the clamping nut is tightened. The fine adjustment is then operated until the fluid assumes the proper level in the tube when the pointers are set. One of these is for normal liquid level, one for the minus limit and one for the plus limit of the part to be tested. These three pointers can be plainly seen in the illustration at the left of the tube, while at the right of the tube is a graduated scale. The metal protecting tube serves as a guide for the holder carrying the pointers and scale. Magnification varies from 800 to 1250 or even more or less if required, the standard being 1000, that is, a motion of 0.001 in. of the pointer moves the liquid 1 in. in the tube, the length of the scale being 2 in. to accommodate work within limits of 0.002 inch.

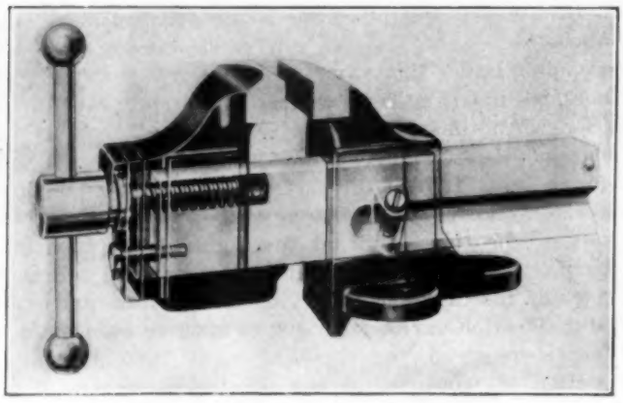
The standard instrument includes a detachable slanting base, which permits the use of the instrument either upright or tilted back without the necessity for removing the column. A feature of the gage is the coned plunger guide which prevents side drag on the diaphragm. The fluid container is located in the supporting arm and can be removed if necessary. The container is made of brass, and the coned plunger guide which screws into the arm holds the former in position. The plunger slides freely in the bearing formed by the lower part of the plunger guide and is pinned to prevent rotation. A box spanner is supplied with the standard gage to remove the plunger guide. A coned plunger guide with a detachable steel nose is also furnished, which makes different calipered plungers readily interchangeable from below without removing the plunger guide proper. Three drilled and tapped lugs are provided on the flat base, the slanting base being provided with corresponding lugs and held in place by means of three screws. The glass indicating tubes can be furnished either with beaded open end, closed bulb or closed bulb with a hole provided on one side. A flexible rubber cap may be slipped over the bead of the open bulb to reduce evaporation.

A tool-steel anvil is provided, which is lapped and hardened and has an angle plate sliding forward and back in two slots. This is claimed to simplify the inspection of cylindrical parts and makes it possible for the operator to adjust the stop so as to get the maximum diameter without experimenting. It also holds cylindrical work at right angles at all times.

Velox Quick-Acting Vise

The Velox Vise Co., Inc., Lowville, N. Y., has recently placed on the market the quick-acting vise shown in the illustration. As may be seen from the phantom view, the bar, which in this vise is made of steel, can be slipped back and forth in the body, while the screw is used only for tightening the front jaw on the work. By lifting slightly on the screw head the bar may be slipped forward or backward until the jaws are approximately the

right distance apart to accommodate the work when a slight turn of the screw tightens the work. It will be noticed that the steel bar is held by means of two screws, one at each side, which bear in slots cut in the sides of the bar. Another feature claimed is that the

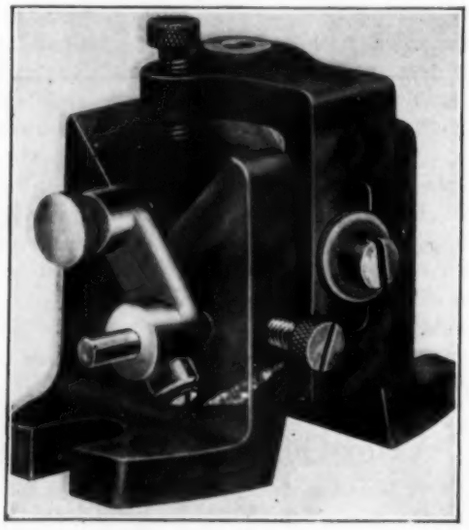


VELOX QUICK-ACTING VISE

narrow bar gives more clearance in the throat of the vise, which is advantageous where deep work is handled. The vise is made in two styles, heavy and light, nine sizes to each style, varying from 2-in. jaws with an opening of 4 in. and weight of 10 lb. to 6-in. jaws with an opening of 11 in. and a weight of 130 lb.

Hill Drilling Jig

The illustration shows a drilling jig that is now being marketed by the M. B. Hill Manufacturing Co., 10 Eden St., Worcester, Mass. The device is designed for drilling short cylindrical work, one side being open so that the chips can be readily brushed out. It will be noticed that the jig is provided with an adjustable stop and has a vertically sliding arm in which the proper



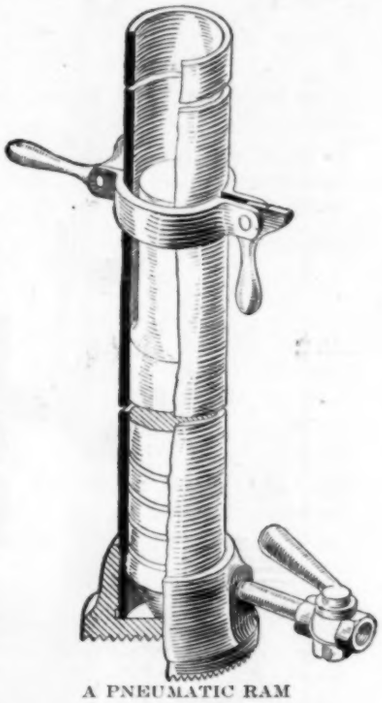
HILL DRILLING JIG

drill jig may be inserted. This arm is also provided with a knurled-head thumbscrew for holding the work securely in place until the drill strikes it. The jig can also be arranged for drilling balls if this work is handled. The dimensions of the base are 2 x 4 in., the capacity is stock up to 1¼ in. in diameter, and the weight is 3 lb. It will be noticed that the device is provided with slots so that it can be bolted to a machine.

A Pneumatic Ram

BY J. LONG

The sketch shows a pneumatic ram, or "gun," which is used around the shops for knocking bolts out of a locomotive frame or similar work, which is usually done with a sledge and which necessitates taking up an awkward position under the machine. It will strike three or four times as fast as a man can with a sledge, and as it delivers a full blow every time it is much more efficient. The base is a casting, the under side of which is checkered so that it will not "walk around" when in use. The chamber of this base is threaded to take a piece of 3-in. extra-heavy pipe bored out smooth to form the cylinder. The ram should be a fairly close fit and its upper end reduced in diameter for about six inches of its length, so that it will not upset and stick in the cylinder. An ordinary plug cock forms the operating valve, the exhaust being through the waste orifice. To facilitate handling the tool and to hold it in position a pair of handles are provided.



A PNEUMATIC RAM

Ordnance Metallurgical Board

In order to assure more complete coördination of the various Ordnance departmental activities along metallurgical lines it has been decided to establish a board on metallurgical matters. The appointment of this board will also assure coördination of similar activities in the different divisions of the War Department and the War Industries Board.

The personnel of the board is as follows: Dr. G. W. Sargent, Engineering Division, chairman; Lieut.-Col. W. P. Barba, Production Division; Major A. E. White, Inspection Division, representing the Ordnance Department; Lieut.-Col. F. B. Richards, Office of the Assistant Secretary of War; L. L. Summers, representing the War Industries Board, and William H. Smith, representing the manufacturers.

The board will act not only for the various sections of the Ordnance Department but also in connection with the manufacturers working for and with the department.

LATEST ADVICES FROM OUR WASHINGTON EDITOR

Washington, D. C., August 31, 1918—So many changes are under way as a result of war conditions that there is hardly any time to note them all. They come so fast and are so radical as compared with anything we have ever known that it is surprising they do not create much more comment.

As an example of Government control of enemy-owned businesses and patents, the decision of the Federal Trade Commission in regard to the Splitdorf Electrical Co. using the patents of the Bosch company is a good example. The Splitdorf company is manufacturing magnetos for army airplanes, and while they very naturally claim that their own designs are equal or superior to that of the Bosch company, Government specifications make it necessary to have some of the Bosch designs incorporated, and this is now being done. These licenses are not exclusive and are to run until the expiration of the patents, nothing being said of the duration of the war.

Women Draftsmen Called For

Another interesting development is the comparatively rapid introduction of women into the various departments, a new civil-service list showing numerous calls for women in the drafting rooms of the different departments of the Army and the Navy. It is not exactly clear just how the line is being drawn, and it is probable that another six months or a year will see much more liberal interpretations as to the positions that are likely to be open to women.

At the present time we find the Ordnance Department is in need of mechanical draftsmen and that either men or women may qualify. In the Navy Department women may qualify as ship draftsmen, architectural, mechanical and structural-steel draftsmen for ship work; radio draftsmen; copyist radio draftsmen; and copyist draftsmen. In the Bureau of Yards and Docks positions as engineering draftsmen are open to them. In the Naval Bureau of Ordnance women can be employed as mechanical draftsmen, and the same is true of the Bureau of Steam Engineering, where there are openings both as electrical draftsmen and marine engine and boiler draftsmen. The Geological Survey of the Interior Department also has openings for women as topographical draftsmen at salaries ranging from $1100 to $2000 a year.

For the most part these positions range from $800 $1800 a year and no discrimination is made as to the sex of the applicant, which is of course as it should be. It is rather difficult to understand just how these lines have been drawn, for if women are acceptable in some positions in the drawing room they should be equally valuable in any other position that they can fill, and any hard and fast rule as to the special departments that they may enter seems decidedly out of place in these days when every available particle of man power (or woman power) is being sought and utilized.

What would be considered an entirely unwarranted interference in private business is being hailed in almost every case with approval as a war measure. The makers of farm wagons and trucks, for example, have been called upon by the Conservation Division of the War Industries Board to greatly reduce the varieties of their products for the purpose of conserving material, especially through the elimination of the avoidable use of steel and iron. A definite restriction as to the size of wheels, the sizes of wagon boxes, the kind of tires and other details of wagon and truck manufacture has been definitely decided upon and evidently accepted willingly by the manufacturers. The control of this is particularly easy, as it is only necessary to refuse priority orders.

The Labor Situation

The labor situation is becoming more acute, as shown by the reports from almost all parts of the country, the shortage of men being so serious as to restrict output in a number of very essential lines. The United States Employment Service is being whipped into shape rapidly, but we must not forget that this is a tremendous problem and one which cannot be satisfactorily solved at a moment's notice. There are many able men and women hard at work on this all-important problem, and they must be assisted in every way rather than cursed and found fault with because the whole of the gigantic machinery is not yet in complete operation.

There is a movement on the part of the United States Employment Service to put the problem of supplying this labor up to the various states. As an example, they are threatening to abandon the $8,000,000 picric-acid plant at Brunswick, Ga., and erect it in another state unless the state of Georgia supplies at once the 5000 laborers that are needed for its completion.

While we can do much to relieve labor shortage by a greater utilization of women workers we must not expect impossibilities, and we must remember that it is necessary to train them the same as men are trained. Women can do remarkably well in many lines only dreamed of little over a year ago, but we must not expect the impossible, and we must also remember that it is equally our duty to utilize every ablebodied man who is not already engaged in an essential industry.

The time may come when many of us can do a great service perhaps by working, even temporarily, at more or less common labor if there happens to be a severe shortage in that particular line. It will likewise give us a much better idea of the real dignity of labor than any amount of preaching that we may hear or do.

Get Ready for the New Tax Bill

The new tax bill is likely to be felt severely by many machine builders. This is always a sensitive subject, but we must remember that war is an expensive proposition, amounting to approximately $50,000,000 a day, according to some of the late figures, and this money must be collected in some way. Paying for the war by issuing bonds is only putting the day of payment further off, and while it is of course necessary to finance a large portion of the war in this way it is generally agreed that a much larger part must be collected by taxation than has been done. The machine-building industry has never yet shirked its duty, and it will face the music in the same soldierly manner as it has the other Government calls to duty. Then too we must remember that even with the most severe impost yet suggested there will be left a 20-per-cent. profit on all war contracts, and we may still have the perhaps doubtfu satisfaction of paying for a large percentage of the cos of the war. We must also remember that taxes can only be collected from those who have the money to pay, and the machine-tool builders will make a splendid showing.

Button for War Workers

The question of how to designate men and women who are engaged in some kind of munition work is still being discussed, but for the most part it has not as yet been decided upon. The United States Aircraft Production Service has, however, adopted the insignia similar to the one which appears on the wings of the airplanes, consisting of a target in red, white and blue, with a pair of wings and the letters "U. S.," which support ribbons bearing the words "Aircraft Industrial Service." It is stated that between 40,000 and 50,000 of these have now been distributed, indicating that many workers in the different airplane factories. This is a step in the right direction, but one can hardly help thinking that the number above stated is entirely out of proportion to the number of airplanes which have as yet been completed.

Lest we dwell too much on the things we have failed to do it is well to look at the other side and occasionally note some of our accomplishments, for we have many which we may well be proud of. Taking the big-gun program alone it is very interesting to note that we now have 15 plants in operation, the lowest of these having 31 per cent. of its machinery now at work; two of them are working at 75 per cent. of their rated capacity, three at 95 per cent. and five at 100 per cent. In addition to this we have the large Neville Island plant at Pittsburgh, Penn., which is being handled by the United States Steel Corporation and which when completed will have a capacity almost as large as all the other 15 which have been already referred to. In other words, this is a $30,000,000 plant, while the total Government expenditures for plant facilities are a little under $65,000,000.

When we consider what an unmilitary nation we were and the length of time required to get into production on work of this kind, we may well be proud of what has been done. True, there have been many annoying delays, but the fact remains that we have actually begun to produce field guns of the smaller sizes at least in encouraging quantities, and there are other parts of the program which will be hailed with great joy as soon as they can be announced. This does not mean that there is any excuse for letting up in our activities along any line, for we must produce war materials in ever-increasing quantities. It is very gratifying, however, to know that things are beginning to come as they should.

Aircraft Situation

The report of the Senate Aircraft Investigation Committee has let loose another flood of criticism in regard to the Aircraft Production Board, and as it did not hesitate mentioning a few of the men it considered responsible much personal comment is being indulged in. Except for an occasional observation, I have refrained from commenting on the aircraft situation in deference to the two investigations that were being carried on, and I have no intention of going into the matter in detail at this time, although there is much that might be said on both sides. The fact remains that in spite of the expenditure of hundreds of millions of dollars, we have secured comparatively few planes for shipment to France, and that even the quality of these is questioned on some points.

On the other hand the President has appointed a director of aircraft production who has the reputation of never having failed in any big job he undertook. This of itself is most encouraging, and those who know John D. Ryan, as well as those of the aircraft industry who have come in contact with him in his appointments, seem to feel that he is the right man in the right place.

It is of course inevitable that these reports be made, and the public has a perfect right to know the exact status of the whole affair. It is hoped, however, that it will be fair enough to give the new administration an opportunity of making good before putting it in the same class as the former management.

There is considerable talk of the necessity of a secretary of aircraft that shall cover both Army and Navy needs. Such a proposition has much to commend it, but we must not forget the existing conditions or the opposition such a proposal is sure to arouse, particularly on the part of the Navy, and in order to be perfectly fair we must consider the naval point of view.

We must not forget that in spite of the failure of the Army to secure its necessary quota of machines the Navy has been steadily adding to its aircraft equipment. Realizing full well that none of the existing machines were perfect, the Navy has nevertheless bought all that could be built of standard make in aircraft suitable for its needs and has successfully adapted this to the use of the Liberty motor. It has even built its own aircraft factory at the Philadelphia Navy Yard, placing it in charge of Commander Frederick G. Coburn, who has made a remarkable record for efficiency in establishing a new plant and getting it into production. This plant devoted itself to building a standard form of naval aircraft while it was developing a newer and better design, and it did not let production rest for a single

minute while its engineers were waiting or were trying to decide upon something better.

In other words the Navy has had sufficient business sense to utilize the existing airplane facilities even though it knew full well that it was not securing an ideal machine. As a result, it has now in operation hundreds of naval aircraft that have been giving excellent accounts of themselves, though the full story of the work they have been doing cannot be written until after the war.

In view of this excellent showing on the part of the Navy it is not to be supposed that it would voluntarily or even willingly give up its control of its aircraft production unless it were assured beyond a doubt that it would be handled at least as efficiently as it has been doing it. It is also doubtful if it would consent to having its aircraft requirements in charge of anyone except a naval man in view of the poor showing that has been made by the corresponding division of the Army.

Probably a consolidation of all aircrafts would be highly desirable, although there are several real obstacles in the way at the present time.

Change in the Ordnance Department

Further changes are taking place in the Ordnance Department, all of which have a direct bearing on production. Col. C. C. Jamieson becomes Chief of the Production Division, and Col. Guy E. Tripp and his assistant, Waldo Marshall, are to become advisers to Gen. C. C. Williams, Chief of Ordnance. These are changes in the right direction, and should have a good effect on production methods.

Changes are of course constantly taking place, and this must necessarily be so, as the program advances.

The question of essential and nonessential industries is bound to become more acute, and it is well for all of us to take account of stock in a number of ways. It is going to be increasingly difficult for all but the most vital industries to secure sufficient steel and similar material, and while the machine-tool industry has little to fear there are perhaps several ways in which it can be of service to the War Industries Board in this connection. The vital importance of machine tools themselves will not be questioned, as all branches of the Government have come to realize their importance to the whole program. The shops utilizing machine tools, however, can be of considerable service by refusing to take on work that is not of an essential character. As an example, I recently received an inquiry from a designer who was about to build an experimental internal-combustion engine and wanted information in regard to necessary details. The inquiry showed that the designer was not thoroughly familiar with the subject and that there seemed to be little likelihood of his being able to develop a motor that would be of service at this time. The ruling of the Power Plant Committee of the National Advisory Council is that developments of this kind should be discouraged and all our energy and material centered on developments that give promise of success. It has decided that consideration should not be given to engine designs of conventional form unless they contain features of self-evident superiority over existing ones on the ground that such conventional designs cannot advantageously replace present engines.

With this as a foundation it is possible for many machine shops to discourage experimental work of this kind, and in view of the fact that almost all shops can easily be kept busy on essential work there is no hardship in turning down such work.

Argument in regard to the draft ages waxes strong and bitter in many cases, and is too often mixed with personal dislike and politics. The taking of boys of 18 years of age and over is a serious step, and all of us who are blessed with sons feel it very keenly. However, we must not overlook the fact that young men practically won the Civil War and also that it will disorganize business and manufacturing much less than where older men are taken.

On the other hand we must not let age or the personality of an individual blind us to the fact that it is absolutely necessary to use every man where he can give the most service. Because he is young and happens to be the son of someone we dislike is no reason for advocating his being taken into the army if he is doing more important work where he is. All the Congressional twaddle about taking Henry Ford's son just because he is Henry Ford's son is illogical from every point of view. If he is doing more important work in his present position than in shouldering a rifle he should be kept on his job. If he can do more good in the trenches that is the place for him. But his parentage or the place he is being utilized in should have no bearing on the discussion.

Coöperating with Our Allies

An earnest attempt is being made to interchange ideas, information and experience with our allies on the other side. As a step in this important work there are now in this country a delegation from France consisting of officers and civilians. The latter are from the French shops and include shop executives and expert workmen.

These men, with the proper escort, will visit the shops in various sections of the country to study our methods, advise us of their way of doing work and give us the benefit of their experience in every way. This can be of great value to our men and they should be welcomed with open arms and made to feel that any advice or suggestions they may offer will be very welcome. No false pride should stand in the way of securing any information.

This visit is to be supplemented by sending some of our men to France as soon as arrangements can be made. These men will be carefully selected from the Ordnance Department and from various plants in this country and they will be given every opportunity to see and learn all that they can from the French shops. The whole idea is excellent and should be heartily supported. The more closely we can knit the allied countries together in every way the better for the winning of the war—and after.

One of the real problems of any organization is its personnel—the kind of people and their capacities. This is equally true of the different divisions of the War Department and should be considered in judging any of their activities.

When we consider the gigantic increase in personnel, necessitating the placing of new and untried men in

responsible positions, wide allowance must be made for errors and examples of poor judgment. But we must not forget, nor let these men forget, that they are no longer in private enterprises, but are a part of the great Government of the United States of America, and as such responsible to all its people.

Most of the criticisms that have been made have been due to the lack of engineering judgment, usually because of the unfamiliarity of the men in question with the work in hand. In a few cases they have been unable to forget their past connections and their future possibilities, but for the most part mistakes have been due to errors in judgment and not to a desire to profiteer. Every volunteer officer can do no better than to note the loyalty and the straightforwardness of the regulars in this respect.

In some cases the selection of men has been injudicious, but this, on the other hand, is difficult to avoid when we consider all sides of the question. The best man to buy tires, for example, would be a man who had been in the tire business before the war. And yet there can be no question but that if such a man is chosen he should at once renounce all connection with any concern making and handling tires.

We are spending money at such a tremendous rate that it is easy to lose the proper perspective—to overlook the fact that a few thousand dollars is just as much worth saving as ever, providing it is a real saving. But while the percentage of waste might be low it is 100 per cent. wrong to overlook the opportunity of securing the best possible returns for the money invested.

Lowest Price Not Always Cheapest

This does not mean that the lowest priced machine should always be bought, for there are many cases where it is wiser to pay a higher price for a better machine. It simply means that everyone should give good, conscientious service, using the best judgment in all cases. Matters involving millions of dollars should be subject to careful engineering scrutiny, as with a private business. For we as a nation must foot the bills some of these days. And we should be glad to pay if we know they are nearly right.

We do not expect perfection; we only expect every man to do the best that is in him. If he makes honest mistakes he is no more fallible than the rest of us. It is only when a man ignores the common-sense usages of private life, becomes carried away with the importance of his position or thinks only of personal gain in reputation or in more substantial ways, that he is to be condemned. And it is a pleasure to state that to the best of our knowledge and belief the great majority of the men on the job are doing their level best.

Service Bureau of the Committee on Public Information

The Committee on Public Information has established a Service Bureau in Washington, D. C., at 15th and G Sts., in charge of F. W. McReynolds. It is the purpose of the bureau to give information regarding officials, functions and location of Government departments, a service which should be particularly valuable in Washington at this time.

Jack Is Looking for a Toolmaker's Job

By James H. Follen

On account of the enormous demand for toolmakers and the lack of trained help in this line a lot of shops are hiring practically anyone who comes in and says he is a toolmaker. As a result a lot of amusing stories are going the rounds. In this case Jack was out of a job and to use his own words, "had to get one or eat the furniture."

He was waiting outside a large plant during the noon hour and happened to meet an employee with whom he was acquainted and from him inquired about the chances of getting a job there. He was told there were openings for toolmakers, and he inquired as to what sort of work a toolmaker must know, and was told they made the jigs, dies and special tools used in the factory, and were paid $5 to $6 a day, or more.

He said: "That's the job for me, all right," and immediately went into the office and asked for the superintendent, and on that worthy's appearance the following conversation was had:

"What can I do for you?"
"I'm looking for a job as a toolmaker."
"What kind of work have you been doing?"
"Making jigs and dies and special tools."
"How much wages do you want?"
"Oh, five or six dollars a day."
"Are you looking for a steady job?"
"Sure."
"All right, come in to work in the morning."

The newly hired "toolmaker" made for the exit highly elated, but on reaching the door he turned around and said: "Oh say, I forgot. Will I bring my shovel?"

Recutting Files

By A. Leigh
Manager S. Entwistle Co., Oldham, England

The article by H. D. Murphy, published in Vol. 48, page 568, of the *American Machinist*, on the subject of "Recutting Files," conveys an erroneous impression. If engineers and machinists are to take the word of Mr. Murphy as correct there is no such thing as a genuine recut file but simply a cleaned one. The method of cleaning files described (acid process) and also the sandblast process have been known and practiced by engineers for years, but I may say that, having intimate knowledge of almost all the file manufacturers of Lancashire, and especially the Manchester district, I can vouch for it that there is not a single firm that practices these cleaning processes only as is required for the cleansing of finished files.

The method of recutting files is the same in the manufacture of new ones, only instead of the file being ground blank from the black it has to be annealed and then rendered blank by grinding out the old teeth. The file then goes through exactly the same process as in the manufacture of new files, and in most of the works where files are recut the equipment for the purpose is equal to that of the best manufacturers that are making new files.

Therefore, why this prejudice against recut files? There is no reason why they should not be as good as new ones.

Joint Meeting of Metal Manufacturers at Milwaukee

The American Foundrymen's Association, the Iron and Steel Section of the American Institute of Mechanical Engineers, the Institute of Metals Division of the American Institute of Mining Engineers and the American Malleable Castings Association will hold a joint meeting at Milwaukee during the week of Oct. 7. Concurrent with these meetings will be conducted an exhibition of all kinds of labor-saving metal-working equipment, every branch of the metal industry being represented, including the gray-iron, steel, malleable-iron, and brass foundry trades; the iron and steel industry, from the mining of the ore to the production of pig iron, its conversion into steel, and finally the rolled product in the brass and copper mill rolling industry. On Aug. 24, 165 manufacturers had announced their intention to be represented.

The meetings of the Allied Metal Trades Association will be opened on Tuesday morning, Oct. 8, with a joint session, at which the address of welcome will be delivered by Emanuel L. Phillips, Governor of Wisconsin, and upon adjournment of this opening session the meetings of the various associations will be called to order in separate halls of the Milwaukee Auditorium, where all the activities of the week of all four societies will be centered.

The American Foundrymen's Association will hold daily meetings in the morning only, beginning Tuesday, Oct. 8; the Institute of Metals Division of the American Institute of Mining Engineers will have one meeting on Tuesday, two on Wednesday and one on Thursday; the Iron and Steel Section of the American Institute of Mining Engineers will hold three meetings and adjourn Wednesday afternoon, and the American Malleable Castings Association will probably hold one meeting only.

A large number of motion pictures will be presented, which will include the manufacture of hand grenades, the civil reëstablishment of wounded and crippled Canadian soldiers, the manufacture and launching of ships at the Hog Island Yard, the building of concrete ships, the manufacture of steel by the triplex process and the cause and prevention of industrial accidents.

One feature of the program of the Institute of Metals Division of the American Institute of Mining Engineers will be the discussion of the conservation of tin, and representatives of various industries using tin will contribute to this symposium.

The following men have been appointed as chairmen of the various committees: Theodore O. Vilter, president Vilter Manufacturing Co., general and finance committees; George Kuemmerlin, Milwaukee Electric Railway and Light Co., finance committee; J. D. Bird, Power and Mining Machinery Co., golf committee; E. Bearman, Illinois Steel Co., reception committee; A. Harrison, Allis-Chalmers Manufacturing Co., plant visitation committee; W. P. O'Connor, Goodrich Transportation Co., banquet committee; James Marshall, George H. Smith Steel Casting Co., theater, automobile and boat excursion committee; A. E. Copeland, ladies' committee.

Bethlehem to Build New Shipyard on the Pacific Coast

With the Victory plant at Squantum completed and boats being launched there every few days the Bethlehem Shipbuilding Corporation has again turned its attention to further expansion and authorized the construction of a new shipyard located at Alameda, Calif., near the present plant of the Union Iron Works.

Contract for the construction of the plant was awarded to the Aberthaw Construction Co., Boston, which recently completed the Victory plant in record time and which has handled practically all the war-time expansion of the Bethlehem Corporation, totaling more than $20,000,000, exclusive of the present work.

The Alameda plant will be the second largest in the United States and will be exceeded in size only by that of Hog Island. It will be twice the size of the Victory plant at Squantum and will involve twice the expenditure. The plant, which will be complete for building on 10 slips, will cover over a third of a square mile and from three to four million yards of dredging will be necessary. Large cargo vessels will be constructed, contracts for which have already been awarded to the Bethlehem Shipbuilding Corporation by the United States Shipping Board.

The formal opening of the work occurred on Aug. 13 when the first pile was driven. There was a big celebration with addresses by Mayor Green of Alameda; W. H. Ryerson of the Aberthaw Construction Co.; Mr. Ely of Monks & Johnson of Boston, the architects and engineers, and by representatives of labor, who pledged their support. Five hundred are at present occupied and it is believed that the construction work will require 15,000 men in a few weeks. It is expected that the plant will be pushed to completion very rapidly and that ships will soon be completed.

A Pledge to Pershing

The Western Cartridge Co., East Alton, Ill., adopted the following pledge as a means to keeping its force at production and maintaining a steady output:

"To General Pershing and Our Boys Over There:

"We, the undersigned president, managers, engineers, mechanics and workmen of the Western Cartridge Co., East Alton, Ill., hereby solemnly pledge:

"To keep constantly in our minds during the hours of work as well as during those of rest that the greatest and most terrible of wars is being fought by our own sons and brothers for the safeguarding of the honor and liberty of all Americans and of the entire civilized world. We realize the vital importance of wholehearted and constant coöperation between us and the fighting man, without which no victory and consequently no peace can ever be won; and therefore

"We vow to stand by them at all times and until the very end, and as they do not relax their fighting we will never relax our work.

"We further solemnly declare that we will not indulge in useless and silly waste of time, money or food for anything beyond normal and necessary recreation.

"We shall live and work as earnestly and as full of purpose here as our boys fight and die over there."

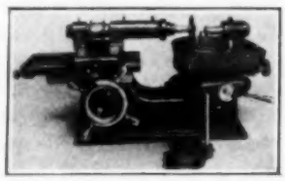
Condensed-Clipping Index of Equipment

Clip, paste on 3 x 5-in. cards and file as desired

Grinding Machine for Cutters

Robbins-Gamwell & Co., Pittsfield, Mass.

"American Machinist," Aug. 15, 1918

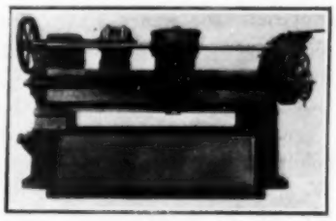


Particularly designed for grinding convex and concave profile cutters. The capacity of the machine is cutters up to 7 in. in diameter. In convex grinding, true half circles can be ground on the periphery of cutters not less than 3 in. in diameter, and arcs of circles less than 180 deg. can be ground with a radius depending upon the diameter of the cutter and ranging from 1⅛ in. on a cutter 7 in. in diameter to ¼ in. on a cutter 2 in. in diameter. On concave cutters a part of a circle slightly less than 180 deg. can be ground on a cutter not less than 3 in. in diameter. Cutters not ordinarily within the limits of the machine as regularly furnished, such as small ones with large radii, can be ground by means of special fixtures furnished as extras if desired. The spindle runs in bronze bearings. The equipment includes a 4-in. grinding wheel with a ½-in. hole and gage for setting the tooth rest. Weight, 245 lb.; bench space, 36 x 18 in.

Milling Machine, Deck-Plate-Scarf

Newton Machine Tool Works, Inc., 23d and Vine Sts., Philadelphia, Penn.

"American Machinist," Aug. 15, 1918



For milling the scarf on deck plates, the head being provided with gear feed in both directions and the spindle saddle with cross-hand adjustment on the rail. Diameter of spindle, 5 in.; vertical adjustment of spindle, 10 in.; maximum distance top of table to end of spindle, 10 in.; width between uprights, 9 ft. 2½ in.; length of feed available for the head on the cross-rail, 9 ft.; top surface of base, 9 ft. 2 in. between uprights and 4 ft. 9 in. at right angles to the cross-rails; feed changes, 6; horsepower of motor, 25; speed changes, 3.

Hacksaw, Rotary "Misener"

Barnes & Irving, Inc., Syracuse, N. Y.

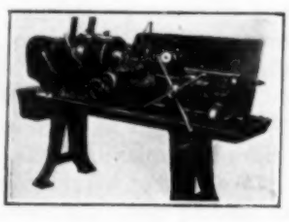
"American Machinist," Aug. 15, 1918

The device is intended for cutting round holes through thin sheet metal or other like uses. In the illustration the saw shown at the front is equipped with a square tapered shank for use in an ordinary bit stock, the device being held in place while the work is being done by means of the small twist drill seen projecting from the center. In the saw shown at the top of the work the twist drill has been replaced by a bolt so that the tool can be fed by means of the hand nut at the top acting through the helical spring just below it. The shanks are mounted with a sort of universal joint at the lower end so that the saw always stays flat against the work. The saws are cylindrical, all those except the one for the proper size of hole being removed when the tool is in use.

Lathe, Turret

Wood Turret Machine Co., Brazil, Ind.

"American Machinist," Aug. 15, 1918

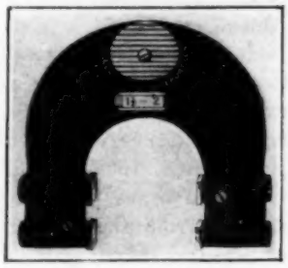


The machine is shown set up for producing the tailstock spindle of a well-known lathe, one of the spindles being in place in the chuck. As may be seen the turret is of the tilted variety and is six-sided, the stop screws for the various operating positions being shown projecting from the end of the slide.

Gages, Snap, Adjustable

J. M. Clark Co., Bridgeport, Conn.

"American Machinist," Aug. 15, 1918

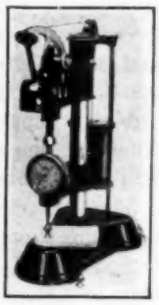


This gage, now being equipped with square-headed plugs which permit measurements to be taken close up to a shoulder, is made in sizes overlapping each other from 0 to 12 in., the entire set consisting of 18 gages. The device may also be furnished with round heads if desired. A feature claimed for this line of gages is the extra-long bearing surfaces of the plugs and yokes cast of an iron that will not spring and take a permanent set if the gage is dropped.

Resiliometer, "Widney"

Advance Felt Specialty and Cutting Co., 233 South Jefferson St., Chicago, Ill.

"American Machinist," Aug. 15, 1918

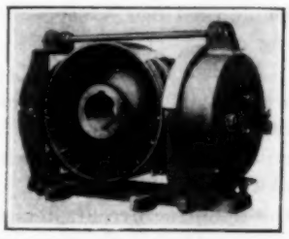


For measuring the thickness, hardness and resiliency of materials such as felt, rubber, leather and other similar products. The instrument consists of a dial indicator on which is mounted a presser foot operating at right angles to the flat base of the machine on which the work is rested. The presser foot is pressed into the material being tested by means of a weight operating through a quadrant and a rack-and-pinion mechanism to the ball at the top of the dial indicator. In operation the quadrant is pulled forward and locked by means of a spring catch when the material can be placed under the presser foot and the normal thickness measured. After the normal thickness of the material has been noted the spring catch is released and the quadrant swung back until it bears on the ball at the top of the indicator. A reading will give the relative hardness of the material. After this reading has been taken the quadrant is pulled back to relieve the material from pressure and the third reading gives the resiliency of the material.

Brake, Magnet-Operated

Cutler-Hammer Manufacturing Co., Milwaukee, Wis.

"American Machinist," Aug. 15, 1918

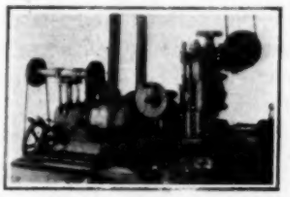


For use on cranes, hoists, bridges, elevators or other such installations. It is claimed that the device is particularly useful where quiet operation is required. By lowering the position of the magnet and making the magnet armature an integral part of one of the arms carrying the brake shoes the construction has been simplified, and fewer parts are required. Compactness is also said to be secured without adding excessive weight. The brake is applied by means of a spring, which tends to force the armature and magnet apart. The force acts directly in line with the center of the brake shoes, a feature that prevents any looseness due to wear in the brake linkage. This feature also makes the retarding torque the same regardless of the direction of rotation. Manufactured in standard sizes varying from 8 to 30 in. in diameter and from 15 to 300 hp. capacity.

Dividing and Milling Head for Lathes

Eccles & Smith, 71 First St., San Francisco, Calif.

"American Machinist," Aug. 22, 1918



Arranged with overhead motive power so that this is delivered to the tool in whatever position it may be. In doing dividing work the work may be held either between centers or in a chuck. The milling device can be attached to the lathe without any fitting and in action is fed by the lead screw feed by means of a belt drive to the lead screw train from the smallest headstock cone. This construction is necessary on account of the fact that for some operations the center or chuck is held stationary while the carriage moves. The indexing mechanism is geared 2 to 80 and uses standard dividing plates, the same as an ordinary milling machine. The worm dividing mechanism is supported by means of a yoke and spindle, a shank fitting into a trunnion, this being supported by bearings fixed to the front journal box. It is possible to turn work on faceplates or between centers.

Patent Applied For

Personals

L. C. Sprague has been promoted to district manager of sales for the Chicago Pneumatic Tool Co. at New York.

C. W. Cross has been appointed a special representative of the Chicago Pneumatic Tool Co. for the sale of pneumatic tools to railroads.

J. A. Klumb, who was formerly master mechanic of the Chicago, Milwaukee & St. Paul R.R., has been transferred from Milwaukee to Madison, Wis.

William Dicks, recently with the Wire Wheel Corporation of America, has been appointed general superintendent of John W. Jepson, Inc., Buffalo, N. Y.

C. C. Horner has been appointed manager of the Cleveland office of the William F. Davis Machine Tool Co., New York. **G. G. Sears,** his predecessor, has been called into army service.

Vance McCarty, for the past 12 years manager of the Pittsburgh branch of the Edward R. Ladew Co., Inc., has been appointed general manager with headquarters in the New York office, 54 Franklin St.

R. W. Davis is now connected with the sales organization of the Cleveland Milling Machine Co., being in charge of the Detroit territory with offices at 705 Dime Bank Building, where a quantity of cutters are carried in stock.

George M. Naylor has resigned as assistant sales manager of T. B. Woods Son's Co., Chambersburg, Penn., and accepted a position with the Fairbanks Co. as manager of the power-transmission division. He is located at the company's main office, 416 Broome St., New York.

Frank P. Obenberger, who has been general superintendent of the A. O. Smith Corporation, Milwaukee, Wis., for the past five years, has resigned that position to become associated with his father in the general management of the John Obenberger Forge Co., West Allis, Milwaukee.

Albert Brown, president of the Society of Motor Manufacturers and Traders of Great Britain and one of the founders of Brown Bros., 22 Great Eastern St., London, E. C., is anxious to work with all agencies with a view to securing coöperation of American, British and French business men in working out the problems involved in after-war development.

E. P. Dillon, manager of the power division at the New York office of the Westinghouse Electric and Manufacturing Co., has resigned to become general manager of the Research Corporation of New York. Mr. Dillon became associated with the Westinghouse company in 1909, having been previously connected with various mining and electrical companies in Colorado. In 1917 he was transferred to the New York office as manager of the railway and power divisions. For several years he was assistant to the manager of the railway and lighting department at East Pittsburgh, Penn.; being in charge of power house and apparatus work.

Obituary

Edwin T. Gorham, for the past 12 years superintendent and mechanical engineer of the Wilmarth & Morman Co., Detroit, Mich., died recently at the age of 51 years.

George William Dickie, naval architect and marine engineer, died suddenly at his home in Oakland, Calif., Aug. 17, 1918, at the age of 74 years. Mr. Dickie was a native of Arboath, Scotland, and went to San Francisco in 1869. In 1870 he erected a gas plant at North Beach for the Pacific Gas Co., which plant, owned by the Pacific Gas & Electric Co., is still in operation. Shortly afterward he designed the first successful triple-expansion engine built in the United States, and a few years later designed the first Scotch marine boiler on the Pacific Coast. From 1870 to 1883 Mr. Dickie was connected with the Risdon Iron Works, entering their employ as draftsman and later rising to the position of consulting engineer and designer. He designed the machinery for deep-mining operations for the famous Con-Virginia mine, installed in 1880, including the deepest pumping apparatus in use up to that time and the air compressors. He also designed and installed the machinery for the first big Spreckels' sugar mill erected in the Hawaiian Islands. He became general manager of the Union Iron Works in 1883, a position he held until 1905 when the plant was purchased by the Schwab interests. During that period he designed many privately owned ships as well as a large number of Government vessels. The best known of these are the old battleships "Oregon," "Wisconsin" and "Ohio" and the cruiser "Olympia," which became Admiral Dewey's flagship. Mr. Dickie retired from active work about four years ago, but following this country's entry into the war he offered his services to the Government and at the time of his death held the position of resident inspector for the United States Shipping Board at the Moore shipbuilding plant in Oakland. Mr. Dickie was a member of the Technical Society of the Pacific Coast, American Society of Naval Architects and Marine Engineers and the American Society of Mechanical Engineers.

Business Items

The Halcomb Steel Co., Syracuse, N. Y., has opened an office at room 712 Connecticut Mutual Life Insurance Building, 36 Pearl St., Hartford, Conn. E. L. Reed is in charge.

The Chicago Pneumatic Tool Co. has started work on an addition to its Cleveland plant, which is expected to double the company's output.

The Dale-Brewster Machinery Co., 545-47 West Washington St., Chicago, Ill., has surrendered its charter as an Illinois corporation but will continue to do business in Illinois under its New York charter, the name being the Dale-Brewster Machinery Co., Inc. There will be no change in location, personnel or policy.

Trade Catalogs

Reamers and Special Tools. Skelton Sales Co., Syracuse, N. Y. Catalog. Pp. 13; 6¾ x 8¼ in. An illustration is given of the reamer, the holder, the curved taper reamer and the spot-facing tool, together with a description of their construction, etc. Several tables are given of the sizes, prices, etc. The last page of this catalog is taken up with grinding instructions.

C-H Electric Soldering Iron and Hand Tools. The Cutler-Hammer Manufacturing Co., Milwaukee, Wis. Folder. Pp. 8; 3½ x 6 in. The folder shows two views of the soldering iron, which has a threaded heating core over which the tip is screwed. A new automatic rack, which has recently been illustrated and described in the pages of the "American Machinist," is explained in detail.

Used Machinery. Terminal Machine Co., 404-408 Broome St., New York. Three circulars giving descriptions, prices and illustrations of used machinery, consisting of boring mills, drilling machines, lathes, grinding, milling, screw and shaping machines, profilers, power presses, etc. On July 1 the company announced that it would pay the freight on all machinery and this feature is prominently brought out in these circulars, which are for free distribution and will be mailed to interested parties upon request.

Electrical Instruments. Westinghouse Electric and Manufacturing Co., East Pittsburgh, Penn. Catalog 3-B, June 1918. Pp. 104; 8½ x 11 in. This catalog supersedes Catalog 3-13, July 1916, and presents a description and illustration of the various Westinghouse instruments, such as switchboards, portable and precision instruments, ammeter shunts, instrument transformers, and relays.

Engines, Compressors, Pumps, Hoists and Mixers. Chris D. Schramm & Son, Inc., Philadelphia, Penn. General catalog No. 18. Pp. 30; 6 x 9 in. It is illustrated and presents a good description and specifications of engines, compressors, pumps, hoists, mixers, generator sets, lighting systems, sawing outfits, rock crushers, tools and other accessories. These catalogs will be supplied only to those interested in the purchase, sale or use of the above-mentioned equipment.

Saw and Knife Fitting Machinery and Tools. Machinery Company of America, Big Rapids, Mich. Catalog No. 30. Pp. 224; 6 x 9 in. This catalog illustrates and describes a very large line of machinery for use in the upkeep of saws and knives of various types. The machinery is for use with both circular and band saws and knives of the straight or circular type.

Machine Vises and Universal Joints. Ainslie Machine and Tool Works, New Park and Jefferson Aves., Hartford, Conn. Catalog. Pp. 8; 3½ x 6 in. A description and illustration of the Vanderbeek machine vises and the Vanderbeek universal joints are given in this catalog showing them in a number of sizes.

Belt Fasteners. The Crescent Belt Fastener Co., 381 Fourth Ave., New York. Service Chart. Form N. Y. 201. Pp. 8½ x 11 in. This chart gives in tabular form data in regard to the length, width, thickness of belts for different sized pulleys and service conditions, and notes the sizes and styles of Crescent fasteners to be used for various belts.

New Publications

Levant American Commercial Review—Published by the Levant American Commercial Co., 27 William St., New York. Price $3 in the United States and Mexico.

This is a new monthly publication, July, 1918, being Vol. 1, No. 1. The object of the publication is the promotion of trade with the Orient and the Far East. In its first issue it rehearses the old and generally discredited theory that in order to secure the full benefit of this foreign trade it is necessary for the United States to adopt the metric system, although it also publishes a short refutation of this by Frederick A. Halsey, commissioner of the American Institute of Weights and Measures. Those who are particularly interested in trade in the Far East will probably want to see a copy of this magazine.

Forthcoming Meetings

The American Foundrymen's Association, the Iron and Steel Section of the American Institute of Mining Engineers, the Institute of Metals Division of the American Institute of Mining Engineers and the American Malleable Castings Association will hold a joint meeting at Milwaukee during the week of Oct. 7, 1918. There will be a large number of manufacturers represented at the exhibition, to be held in the Milwaukee Auditorium, and many papers will be read. Theodore O. Vilter, president of the Vilter Manufacturing Co., is chairman of the general committee.

American Gear Manufacturers' Association will hold its semi-annual meeting at the Onondaga Hotel, Syracuse, N. Y., Sept. 19, 20 and 21.

American Society of Mechanical Engineers. Monthly meeting second Tuesday. Calvin W. Rice, secretary, 29 West 39th St., New York City.

Boston Branch National Metal Trades' Association. Monthly meeting on first Wednesday of each month. Young's Hotel. Donald H. C. Tullock, Jr., secretary. Room 41, 166 Devonshire St., Boston, Mass.

Engineers' Society of Western Pennsylvania. Monthly meeting, third Tuesday; section meeting, first Tuesday. Elmer K. Hiles, secretary, Oliver Building, Pittsburgh, Penn.

New England Foundrymen's Association. Regular meeting, second Wednesday of each month. Exchange Club, Boston, Mass. Fred F. Stockwell, 205 Broadway, Cambridgeport, Mass.

Philadelphia Foundrymen's Association. Meetings first Wednesday of each month. Manufacturers' Club, Philadelphia, Penn. Howard Evans, secretary, Pier 45, North Philadelphia, Penn.

Providence Engineering Society. Monthly meeting fourth Wednesday of each month. A. E. Thornley, corresponding secretary, P. O. Box 796, Providence, R. I.

Rochester Society of Technical Draftsmen. Monthly meeting, last Thursday. O. L. Angevine, Jr., secretary, 857 Genesee St., Rochester, N. Y.

Superintendents' and Foremen's Club of Cleveland. Monthly meeting, third Saturday. Philip Frankel, secretary, 310 New England Building, Cleveland, Ohio.

Technical League of America. Regular meeting, second Friday of each month. Oscar S. Teale, secretary, 240 Broadway, New York City.

Traveling Engineers' Association will hold its twenty-sixth annual convention in Chicago, Ill., on Sept. 10, 1918. W. O. Thompson, general offices, New York Central R.R., Cleveland, Ohio, is the secretary.

Western Society of Engineers, Chicago, Ill. Regular meetings, first, second, third and fourth Mondays of each month, except July and August. Edgar S. Nethercut, secretary, 1735 Monadnock Block, Chicago, Ill.

WEEKLY PRICE GUIDE OF

IRON AND STEEL

The Government Schedule of steel prices went into effect Sept. 24. Pig iron was set at $33 per ton; pig iron differentials were announced by the American Iron and Steel Institute on Nov. 3. Washington announced sheet and pipe prices on Nov. 5. Warehouse prices have been revised, as shown, by agreement between the War Industries Board and the warehouses; new schedule in effect Nov. 15. Effective Apr. 1, the price of basic iron was fixed at $32, and standard Bessemer at $35.20 at Valley furnace, prices of other irons remaining the same as last quarter.

PIG IRON—Quotations per ton were current as follows at the points and dates indicated:

	Current	One Month Ago	One Year Ago
No. 2 Southern Foundry, Birmingham	$33.00	$33.00	$47.00
No. 2X, New York	34.40	34.40	53.00
No. 2 Northern Foundry, Chicago	33.00	33.00	55.00
*Bessemer, Pittsburgh	35.20	36.60	52.95
*Basic, Pittsburgh	32.00	32.00	50.95
No. 2X, Philadelphia	34.40	34.40	53.00
*No. 2, Valley	33.00	33.00	53.00
No. 2 Southern Cincinnati	36.90	36.90	49.90
Basic, Eastern Pennsylvania	32.90	32.90	50.00

*Delivered Pittsburgh; f.o.b. Valley, 95 cents less.

STEEL SHAPES—The following base prices per 100 lb. are for structural shapes 3 in. by ¼ in. and larger, and plates ¼ in. and heavier, from jobbers' warehouses at the cities named:

	New York			Cleveland		Chicago	
	Current	One Month Ago	One Year Ago	Current	One Year Ago	Current	One Year Ago
Structural shapes	$4.245	$4.245	$5.25	$4.17	$4.50	$4.27	$5.00
Soft steel bars	4.145	4.145	5.00	4.07	4.50	4.17	4.50
Soft steel bar shapes	4.145	4.145	5.00	4.17	4.50	4.17	4.50
Soft steel bands	4.995	4.995	....	....	....	....	....
Plites, ¼ to 1 in. thick	4.495	4.495	9.00	4.42	7.00	4.25	9.00

BAR IRON—Prices per 100 lb. at the places named are as follows:

	Current	One Year Ago
Pittsburgh, mill	$3.50	$4.75
Warehouse, New York	4.75	4.75
Warehouse, Cleveland	4.10	4.95
Warehouse, Chicago	4.10	4.50

STEEL SHEETS—The following are the prices in cents per pound from jobbers' warehouse at the cities named:

	Pittsburgh, Mill, in Carloads	New York			Cleveland		Chicago	
		Current	One Month Ago	One Year Ago	Current	One Year Ago	Current	One Year Ago
*No. 28 black	5.00	6.495	6.495	10.50	6.42	9.00	6.52	10.00
*No. 26 black	4.90	6.395	6.395	10.40	6.32	8.90	6.42	9.90
*Nos. 22 and 24 black	4.85	6.345	6.345	10.35	6.27	8.85	6.37	9.85
Nos. 18 and 20 black	4.80	6.295	6.295	10.30	6.22	9.20	6.32	9.80
No. 16 blue annealed	4.45	5.695	5.695	10.20	5.62	9.20	5.72	10.20
No. 14 blue annealed	4.35	5.595	5.595	10.10	5.52	9.10	5.62	10.10
No. 10 blue annealed	4.25	5.495	5.495	10.00	5.42	9.00	5.52	10.00
*No. 28 galvanized	6.25	7.745	7.745	13.00	7.67	10.75	7.77	11.50
*No. 26 galvanized	5.95	7.445	7.445	12.70	7.37	10.45	7.32	11.20
No. 24 galvanized	5.80	7.295	7.295	12.55	7.22	10.30	7.47	11.05

***For painted corrugated sheets add 30c. per 100 lb. for 25 to 28 gage; 25c. for 19 to 24 gages; for galvanized corrugated sheets add 5c., all gages.**

COLD DRAWN STEEL SHAFTING—From warehouse to consumers requiring at least 1000 lb. of a size (smaller quantities take the standard extras) the following discounts hold:

	Current	One Year Ago
New York	List plus 12%	List plus 25%
Cleveland	List plus 12%	List plus 10%
Chicago	List plus 13%	List plus 10%

DRILL ROD—Discounts from list price are as follows at the places named:

	Extra	Standard
New York	35%	40%
Cleveland	35%	40%
Chicago	35%	40%

SWEDISH (NORWAY) IRON—The average price per 100 lb., in ton lots is:

	Current	One Year Ago
New York	$15.50–19	$14.00
Cleveland	20.00	13.30
Chicago	19.00	12.50

In coils an advance of 50c. usually is charged.

Note—Stock very scarce generally.

WELDING MATERIAL (SWEDISH)—Prices are as follows in cents per pound f.o.b. New York, in 100-lb. lots and over:

Welding Wire*		Cast-Iron Welding Rods	
5/32, 11, 9, 7/64, 5/64, No. 8, 3/32 and No. 10	22.10 to 33.00	1/4 by 12 in. long	16.00
1/8		1/4 by 19 in. long	14.00
No. 12		5/16 by 19 in. long	12.00
5/64, No. 14 and 1/16		1/8 by 21 in. long	12.00
No. 18			
No. 20			

* Very scarce.

*Special Welding Wire	
1/8	33.00
5/32	30.00
1/4	38.00

MISCELLANEOUS STEEL—The following quotations in cents per pound are from warehouse at the places named:

	New York Current	Cleveland Current	Chicago Current
Tire	4.15	4.07	4.17
Toe calk	5.75	4.85	4.32
Openhearth spring steel (heavy)	8.00	8.00	8.00
Spring steel (light)	11.00	11.25	11.75
Coppered bessemer rods	9.00	8.00	7.07
Hoop steel	4.99½	4.75	5.02
Cold-rolled strip steel	8.50	8.25	8.57
Floor plates	6.50	6.00	7.07

PIPE—The following discounts are for carload lots f.o.b. Pittsburgh; basing card of Nov. 6, 1917, for steel pipe and for iron pipe:

BUTT WELD

Steel			Iron		
Inches	Black	Galvanized	Inches	Black	Galvanized
⅛, ¼ and ⅜	44%	17½%	⅜ to 1½	33%	17%
½	48%	33½%			
¾ to 3	51%	37½%			

LAP WELD

2	44%	31½%	2	26%	12%
2½ to 6	47%	34½%	2½ to 4	28%	15%
			4½ to 6	28%	15%

BUTT WELD, EXTRA STRONG PLAIN ENDS

⅛, ¼ and ⅜	40%	22½%	⅜ to 1½	33%	18%
½	45%	32½%			
¾ to 1½	49%	36½%			

LAP WELD, EXTRA STRONG PLAIN ENDS

2	42%	30½%	2	27%	14%
2½ to 4	45%	33½%	2½ to 4	29%	17%
4½ to 6	44%	32½%	4½ to 6	28%	16%

Stock discounts in cities named are as follows:

	New York		Cleveland		Chicago	
	Black	Galvanized	Black	Galvanized	Black	Galvanized
⅛ to 3 in. steel butt welded	33%	16%	43%	28%	41.9%	26.9%
3½ to 3 in. steel lap welded	15%	+3%	39%	25%	37.9%	23.9%

Malleable fittings, Class B and C, from New York stock sell at list price. Cast iron, standard sizes, 10 and 5%.

METALS

MISCELLANEOUS METALS—Present and past New York quotations in cents per pound, in carload lots:

	Current	One Month Ago	One Year Ago
Copper, electrolytic	26.00*	26.00	26.00
Tin in 5-ton lots	88.00	94.00	61.75
Lead	8.05	8.05	10.50
Spelter	9.50	8.62	8.00

*Government price.

ST. LOUIS

Lead	7.75	7.75	10.25
Spelter	9.25	8.37½	7.75

At the places named, the following prices in cents per pound prevail, for 1 ton or more:

	New York			Cleveland		Chicago	
	Current	One Month Ago	One Year Ago	Current	One Year Ago	Current	One Year Ago
Copper sheets, base	38.00	38.00	36.00	38.00	38.00	33.50	37.50
Copper wire (carload lots)	35.00	35.00	38.50	35.00	38.00	33.00	39.50
Brass Sheets	39.75	39.75	40.00	37.00	36.00	31.50	40.50
Brass pipe	46.00	46.00	43.00	42.00	46.00	41.50	44.00
Solder (half and half) (case lots)	60.00	60.00	39.25	57.50	39.50	56.00	39.25

Note:—Solder very scarce.

Copper sheets quoted above hot rolled 16 oz., cold rolled 14 oz. and heavier, add 1c.; polished takes 1c. per sq.ft. extra for 20-in. widths and under; over 20 in., 2c.

BRASS RODS—The following quotations are for large lots, mill, 100 lb. and over, warehouse; 25% to be added to mill prices for extras; 50% to be added to warehouse price for extras:

	Current	One Year Ago
Mill	$32.25	$42.00
New York	34.25	38.00
Cleveland	35.00	34.00
Chicago	29.50	37.00

ZINC SHEETS—The following prices in cents per pound prevail:

Carload lots f.o.b. mill 15.00

	In Casks		Broken Lots	
	Current	One Year Ago	Current	One Year Ago
Cleveland	18.75	21.00	18.40	21.50
New York	16.50	23.00	17.00	23.25
Chicago	22.00	22.50	21.50	23.50

ANTIMONY—Chinese and Japanese brands in cents per pound, in ton lots, for spot delivery, duty paid:

	Current	One Year Ago
New York	14.25	14.50
Chicago	15.00	17.50
Cleveland	16.25	16.50

SHOP MATERIALS AND SUPPLIES

OLD METALS—The following are the dealers' purchasing prices in cents per pound:

	New York Current 1918	New York One Yr. Ago	Cleveland Current 1918	Cleveland One Yr. Ago	Chicago
Copper, heavy and crucible	24.00	24.00	24.00	26.75	22.50
Copper, heavy and wire	22.50	23.00	23.50	24.75	22.35
Copper, light and bottoms	20.50	21.00	21.50	22.00	21.50
Lead, heavy	7.25	8.50	.....	9.75	7.35
Lead, tea	5.50	6.50	7.50	7.75	6.15
Brass, heavy	14.75	16.00	16.00	18.00	23.00
Brass, light	11.00	12.00	12.50	14.00	12.85
No. 1 yellow brass turnings	13.75	15.50	14.00	15.00	13.35
Zinc	6.00	6.00	6.50	7.00	5.75

ALUMINUM—The following prices are from warehouse at places named:

	New York	Cleveland	Chicago
No. 1 aluminum, guaranteed over 99% pure, in ingots for remelting (1-15 ton lots), per lb.	33.20c.	32.20c.	33½c.

This is the Government price for lots of from 1 to 14 tons.

COPPER BARS from warehouse sell as follows in cents per pound, for ton lots and over:

	Current	One Year Ago
New York	32.00	41.00
Chicago	38.00	39.00
Cleveland	36.50	41.00

BABBITT METAL—Warehouse price per pound:

	New York Current	New York One Year Ago	Cleveland Current	Cleveland One Year Ago	Chicago Current	Chicago One Year Ago
Best grade	125.00	70.00	103.00	70.50	96.00	70.00
Commercial	70.00	40.00	23.00	24.50	25.00	25.00

SHOP SUPPLIES

NUTS—From warehouse at the places named, on fair-sized orders, the following amount is deducted from list:

	New York Current	New York One Year Ago	Cleveland Current	Cleveland One Year Ago	Chicago Current	Chicago One Year Ago
Hot pressed square	$2.50*	List	$1.20	$1.65	$1.05	$3.00
Hot pressed hexagon	2.50*	List	1.00	1.50	.85	3.00
Cold punched hexagon	2.50*	List	.75	1.25	1.00	2.00
Cold punched square	2.50*	List	.75	1.25	1.00	1.60

* List plus.

Semifinished nuts sell at the following discounts from list price:

	Current	One Year Ago
New York	40%	50%
Chicago	50%	50%
Cleveland	60%	50%

MACHINE BOLTS—Warehouse discounts in the following cities:

	New York	Cleveland	Chicago
⅝ by 4 in. and smaller	30%	45%	37%
Larger and longer up to 1 in. by 30 in.	15%	37%	25—5%

WASHERS—From warehouses at the places named the following amount is deducted from list price:

For wrought-iron washers:
New York ..... $2.50 Cleveland ..... $1.50 Chicago $2.50

For cast-iron washers the base price per 100 lb. is as follows:
New York ..... $5.00 Cleveland ..... $4.00 Chicago $3.50

CARRIAGE BOLTS—From warehouses at the places named the following discounts from list are in effect:

	New York	Cleveland	Chicago
⅝ by 4 in. and smaller	30%	45%	37%
Larger and longer up to 1 in. by 30 in.	15%	30%	25—5%

COPPER RIVETS AND BURS sell at the following rate from warehouse:

	Rivets Current	Rivets One Year Ago	Burs Current	Burs One Year Ago
Cleveland	List plus 10%	List plus 10%	List plus 10%	List plus 10%
Chicago	List price	List price	List plus 20%	List price
New York	20% from list	List plus 10%	List plus 20%	10-2½% from list

RIVETS—The following quotations are allowed for fair-sized orders from warehouse:

	New York	Cleveland	Chicago
Steel ½ and smaller	30%	45—5%	45%*
Tinned	30%	45—5%	45%*

Button heads, ⅝, ¾, 1 in diameter by 2 in. to 5 in. sell as follows per 100 lb.
New York..$5.65 Cleveland..$5.15 Chicago..$5.67 Pittsburgh..$4.65
Coneheads, same sizes:
New York..$5.75 Cleveland..$5.25 Chicago..$5.77 Pittsburgh..$4.75

MISCELLANEOUS

SEAMLESS DRAWN TUBING—The base price in cents per pound from warehouse in 100-lb. lots is as follows:

	New York	Cleveland	Chicago
Copper	49.00	42.50	39.50
Brass	40.00	40.00	44.00

For immediate stock shipment 3c. is usually added. The prices of course vary with the quantity purchased. For lots of less than 100 lb. but not less than 75 lb., the advance is 1c.; for lots of less than 75 lb. but not less than 50 lb., the advance is 2½c. over base (100-lb. lots); for less than 50 lb. but not less than 25 lb., 5c. should be added to the base price: and for quantities under 25 lb. the increase above base is 10c.

TIN PLATES—Warehouse prices per box:

Coke tin plate, 14 x 20:

	Cleveland Current	Cleveland One Yr. Ago	Chicago Current	Chicago One Yr. Ago
100 lb.	$10.00	$12.00	$10.60	$11.75
I. C. 107 lb.	10.15	12.17½	10.70	11.90

Terne plate, 20 x 28:

Base Weight	Net Weight	Coating				
100 lb.	200	3	18.95	18.70	19.10	17.50
I. C.	214	8	19.25	19.00	19.40	17.85
I. C.	270	8	21.75	21.50	21.40	19.95
I. C.	218	12	21.75	19.85	22.60	18.85
I. C.	221	15	22.50	20.35	22.10	19.10
I. C.	226	30	23.25	21.75	22.60	20.15
I. C.	231	25	24.50	22.20	23.10	20.90
I. C.	236	30	25.75	23.50	23.60	21.85
I. C.	241	35	26.75	24.50	25.10	22.85
I. C.	246	40	28.00	25.75	25.60	24.15

NOTE—New York prices furnished on application to dealers. Price varies according to whether the plates are wanted for work essential to the war or for nonessential work.

COTTON WASTE—The following prices are in cents per pound:

	New York Current	New York One Year Ago	Cleveland	Chicago
White	11.00 to 13.00	13.00	16.50	12.00 to 16.50
Colored mixed	8.50 to 12.00	12.00	13.00	11.50 to 14.00

WIPING CLOTHS—Jobbers' price per 1000 is as follows:

	13¼ x 13¼	13¼ x 20⅛
Cleveland	52.00	68.00
Chicago	48.00	50.00

SAL SODA sells as follows per 100 lb.:

	Current	One Month Ago	One Year Ago
New York	$1.75	$1.75	$1.75
Philadelphia	1.75	1.75	1.75
Cleveland	2.40	2.40	2.10
Chicago	2.00	2.00	2.00

ROLL SULPHUR in 360-lb. bbl. sells as follows per 100 lb.:

	Current	One Month Ago	One Year Ago
New York	$4.30	$4.30	$2.85
Cleveland	4.60	4.60	4.60
Chicago	4.00	4.00	3.25

COKE—The following are prices per net ton at ovens, Connellsville, and cover the past four weeks:

	Aug. 22	Aug. 15	Aug. 8	Aug. 1	July 25
Prompt furnace	$6.00	$6.00	$6.00	$6.00	$6.00
Prompt foundry	7.00	7.00	7.00	7.00	7.00

FIRE CLAY—The following prices prevail:

	Current
Chicago, 450-lb. bbl.	$2.50
Cleveland, 375-lb. bag	2.50

LINSEED OIL—These prices are per gallon:

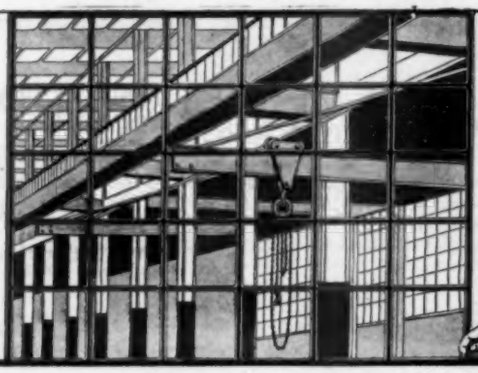
	New York Current	New York One Year Ago	Cleveland Current	Cleveland One Year Ago	Chicago Current	Chicago One Yr. Ago
Raw in barrels	$1.90	$1.26	$2.10	$1.30	$2.05	$1.20
5-gal. cans	2.00	1.36	2.25	1.40	2.25	1.30

WHITE AND RED LEAD in 500-lb. lots sells as follows in cents per pound:

	Red Current Dry	Red Current In Oil	Red 1 Year Ago Dry	Red 1 Year Ago In Oil	White Current Dry and In Oil	White 1 Year Ago Dry and In Oil
100-lb. keg	14.00	14.50	13.25	13.50	14.00	13.00
25 and 50-lb. kegs	14.25	14.75	13.50	13.75	14.25	13.25
12½-lb. keg	14.50	15.00	13.75	14.00	14.50	13.50
5-lb. cans	——	——	15.25	15.50	16.00	15.50
1-lb. cans	——	——	15.25	15.50	17.00	15.50

NEW *and* ENLARGED SHOPS

Consult the Buying Section when in need of machinery or supplies



WASHINGTON, D. C.

The Navy aims to give information regarding its purchases to all manufacturers known to be in a position to supply its demand. Owing to the need of prompt action in the cases of all machine tools hereinafter listed, the Navy cannot arrange to permit a postponement of the opening of bids if the manufacturers are able to secure bidding forms and submit their bids prior to date fixed for opening.

In case time does not permit this, it will be appreciated if any manufacturer not receiving information directly regarding these purchases will notify the Purchasing Division, Bureau of Supplies & Accounts, Navy Department, Washington, D. C., in order that the firm's name may be properly listed for all future purchases.

The Bureau of Supplies and Accounts will soon receive bids for furnishing machines and machine tools, as follows:

Schedule No. 1939, 1 motor driven machine pump; 3 portable, pneumatic, bending machines; 3 motor driven, pipe cutting and threading machines; 2 motor driven, 1¼ in., double head bolt machine cutters; 1 motor driven, disc grinder; 1 motor driven grinder; 1 senistive, ball bearing bench type machine; 1 motor driven, floor type drill; 1 sensitive floor type machine drill; 1 motor driven, all geared, drilling and tapping machine; 1 vertical, motor driven, standard drill; 1 vertical, 8 spindle, multiple, machine drill; 1 No. 4 and 1 No. 5 arbor press machine; delivery Philadelphia, Penn.

Schedule No. 1940, 3 Beckford, 42 in., regular friction drills; 1 grinding machine; 2 flat, belt driven, turret lathes; 2 belt driven, No. 12, profiling machines, 2 No. 3 duplex milling machines; 2 horizontal, drilling and milling, boring machines; 1 vertical, spindle, milling machine; delivery Wash., D. C.

The Bureau of Supplies and Accounts, Navy Department, will receive bids for furnishing machines and machine tools, as follows:

Sept. 16—Schedule No. 1937, 3 radial drills, 6 bench grinders, 4 tool grinders, 1 grinding machine, 4 boring machines, 3 hacksaw machines, 3 milling machines, 2 screw machines, 8 engine lathes, 5 turret lathes, 24 turning lathes, 16 variable speed lathes, 6 arbor presses and 4 crank slotters; delivery Wash., D. C.

Schedule No. 1928, 1 auto lathe, 5 turret lathes, and 2 profiling machines; delivery Newport, R. I.

The Bureau of Supplies and Accounts, Navy Department, received bids for furnishing machines and machine tools, as follows:

Schedule No. 5231½, Class 965, 3 automatic, turret machines, delivery Newport, R. I., from National Acme Co., 7500 Stanton Ave., Cleveland, Ohio, $2975.

Schedule No. 1893, Classes 361, 362 and 363, 1 jointer, each; Class 364, 20 jointers; Class 365, 1 rip saw machine; Class 366, 2 rip sawing machines; Class 367, 2 machines; Class 368, 1 combination saw and dado machine; Class 369, 2 saw benches; Class 370, 1 saw machine; Class 371, 1 sawing machine; Class 372, 1 machine; Class 373, 1 sawing machine; Class 374, 1 matching machine; Class 375, grimmers and grinders; Class 376, 1 rod and dowel machine; Class 377, 1 tenoning machine; Class 378, 1 heavy tenoning machine; Class 379, 1 mortise machine; Class 380, 1 mortiser; Class 381, 1 chisel mortiser; Class 382, 1 dovetailing machine; Class 383, 1 sanding machine; Class 384, 1 shaping machine; Class 385, 1 surfacing machine; Class 386, 1 surfacer; Class 387, 1 sand machine; Class 388, 1 automatic machine; Class 389, 1 grinder; Class 390, 1 grinding machine; Class 391, 1 nailing machine; Class 392, 11 milling machines, (bid "A" belt driven, equipped with necessary countershaft and pulleys, bid "B" motor driven); Class 393, 5 screw cutting, engine lathes, (bid "A" belt driven, bid "B" motor driven); Class 394, 12 plain milling machines, (bid "A" belt driven, bid "B" motor driven); and Class 395, 11 milling machines (bid "A" belt driven, bid "B" motor driven); delivery Wash., D. C.; from American Woodworking Machinery Co., 591 Lyell Ave., Rochester, N. Y., (361) $455, (362) $499, (363) $615, (364) $2400, (365) $398, (366) $878, (367) $1514, (368) $593, (369) $870, (371) $547, (372) $481, (373) $667, (377) $578, (378) $1065, (379) $674, (380) $866, (384) $863, (385) $1601, (386) $729, (389) $425; Briggs Machine Co., 238 2nd Ave., Pittsburgh, Penn., (361) $499, alternate $495, (362) $550, alternate $540, (363) $636, alternate $625, (365) $585, (367) $952, (368) $750, (369) $687, (371) $615, $227, (372) $563, alternate $415, (373) $1074, alternate $1428, (377) $685, (378) $778, 838, 902, (379) $495, (386) $742; J. A. Fay & Eagan, John and Front St., Cincinnati, Ohio, (361) $486, alternate $715, (362) $561, alternate $787, (363) $695, alternate $913, (365) $641, (366) $1272, alternate $1373, (367) $1605, alternate $1845, (368) $691, (369) $851, alternate $914, alternate $1075, (371) $596, alternate $639, alternate $676, (372) $595, alternate $639, alternate $676, (374) $1449, (377) $673, alternate $710, alternate $774, (379) $587, (380) $924, $1013, $1075, (381) $2430, $2780, $3180, (384) $1257, (385) $1837, 2143, (386) $729, alternate $918, (389) $652, $950; Manning, Maxwell & Moore, 119 West 40th St., New York City, (361) $384, (362) $421, (363) $524, (368) $589, (369) $564, (370) $224, (371) $801, (372) $801, (373) $1212, (375) $1737, part bid, (385) $2217, (393) $23,618, bid "A" $11,577, bid "B," (394) $950, alternate $1078; Newman Machine Co., Greensboro, N. C., (361) $415, (362) $457, (364) $157, part bid, (377) $520, (378) $620; Oliver Machine Co., 50 Church St., New York City, (361) $497, (362) $525, (363) $658, (365) $784, (369) $929, (371) $809, (372) $627, (375) $1020, part bid, (377) 782, (379) $521, (383) $841, (384) $973, (385) $1450, (386) $888, (387) $1127, (388) $312; C. O. Porter Machine Co., 666-8 Front St., N. Grand Rapids, Mich., (361) $480, (362) $515, (363) $625, (370) $245, (384) $850, (386) $750; P. Pryibil Machine Co., 520 West 41st St., New York City, (361) $258, (362) $410, (365) $300, (369) $660, (370) $320, (371) $355, (372) $525, (379) $260, (384) $715; H. B. Smith Machine Co., Smithville, N. J., (361) $446, (362) $510, (363) $639, (366) $1436, (368) $592, (371) $416, (372) $416, (377) $505, (378) $727, (379) $540, (384) $524, $641, (385) $1972, (386) $822, (389) $238; J. T. Towsley Manufacturing Co., 1037 Evans St., Cincinnati, Ohio, (361) $470, (362) $505, (363) $685, (372) $665, (378) $930, (386) $960; P. B. Yates Machine Co., Beloit, Wis., (361) $480, (362) $507, (363) $565, (365) $384, (366) $1260, (367) $438, part bid, (371) $560, (372) $560, (373) $650, (374) $1700, (385) $1505, (386) $810, $950, (389) $756; Kemp Machinery Co., 223 North Calvert St., Baltimore, Md., (361) $279, $394, (362) $412, alternate $426, (363) $509, alternate $524, (364) $105, (365) $497, (368) $601, (369) $611, (370) $221, (371) $625, (372) $438, (373) $625, (375) $173, part bid, alternate $2025, alternate $3210, (377) $733, (378) $946, (379) $355, (384) $442, (385) $890, (386) $630, (389) $384, (393) Bid "A" $19,677, "B" $9211, part bid; S. A. Woods Machine Co., Damrell St., Boston, Mass., (362) $1419, (384) $1524; National Metal Spinning and Stamping Co., 179 Grand St., New York City, (364) $135, part bid, (365) $495, (366) $891; J. D. Wallace & Co., 1401 West Jackson Blvd., Chicago, Ill., (364) $107; Hermance Machinery Co., 178 Campbell St., Williamsport, Penn., (366) $1184, (368) $596, (377) $630, (378) $733; Mattison Machinery Co., Beloit, Wis., (366) $1425; Morgan Machine Co., 1100 University Ave., Rochester, N. Y., (374) $989, (390) $236, (391) $787; The Machine Co., Jackson, Mich., (375) $1447; W. S. Hawker Manufacturing Co., 458 East Bacon St., Dayton, Ohio, (376) $1827; Greenlee Bros., 12th St., Rockford, Ill., (377) $755, (378) $1120, (379) $651, (380) $886, (381) $1673, $1986; Alexander Dodds Co., Grand Rapids, Mich., (382) $1010; C. Besley & Co., Chicago, Ill., (383) $1435, $1300, (387) $1280; Advance Machinery Co., 424 Broome St., New York City, (384) $1675, $1505; E. D. Whitney & Son, 15 Elm St., Winchendon, Mass., (384) $1175, (385) $1585, (386) $1460; Becker Milling Machine Co., Hyde Park (Boston), Mass., (392) $34,979, alternate $43,443, alternate $43,300, alternate $41,231, alternate $41,702; Cincinnati Milling Machine Co., Marburg Ave. and South St., Oakley, (Cincinnati), Ohio, (392) Bid "A" $19,922, part bid; "B" $22,120, part bid; Sherritt, & Stoer Co., Finance Bldg., Philadelphia, Penn., (393) Bid "A" $27,765, "B" $26,161; Aumen Machinery Co., 107-9 East Lombard St., Baltimore, Md., (393) Bid "A" $27,512, "B" $27,100, $22,755; Driggs Manufacturing Corporation, 50 Whitney Ave., New Haven, Conn., (393) Bid "B" $19,194; Fairbanks Co., Colorado Bldg., Wash., D. C., (394) Bid "A" $1845, (395) Bid "A" $15,058.

Schedule No. 5345¼, Class 963, screw machines, delivery Wash., D. C., from National Acme Co., 7500 Stanton Ave., Cleveland, Ohio, $2030.

Schedule No. 5228¼, Class 964, toolmakers lathes; Class 969, six universal milling machines, delivery Newport, R. I., from Hendey Machine Co., 105 Summer St., Torrington, Conn., (964) $2013; Kemp Machinery Co., 223 North Calvert St., Baltimore, Md., (964) $1745; Manning, Maxwell & Moore, 119 West 40th St., New York City, (964) $2074; Electric Machinery and Supply Co., Cleveland, Ohio, (964) $1207; Fairbanks Co., Colorado Bldg., Wash., D. C., (964) $1806; Brown Sharpe Co., Promenade St., Providence, R. I., (969) bid "A" $2446, bid "B" $2336; Cleveland Milling Machine Co., 18511 Euclid Ave., Cleveland, Ohio, (969) bid "A" $3225; Fox Machine Co., 1304 West Ganson St., Jackson, Mich., (969) bid "A" $1300; D. Nast Machinery Co., Bourse Bldg., Philadelphia, Penn., (969) bid "B" $3380; Henry Prentiss, 149 Broadway, New York City, (969) bid "B" $3085.

Schedule No. 5363¼, Class 986, 1 surfacing grinding machine, from Kemp Machine Co., 223 North Calvert St., Baltimore, Md., $1217; Manning, Maxwell & Moore, 119 West 40th St., New York City, $687.

Schedule No. 5285¼, Class 994, 1 engine lathe, delivery f.o.b. cars, from Bridgeford Machine Tool Works, Winton Rd., N., Rochester, N. Y., $4950; Manning, Maxwell & Moore, 119 West 40th St., New York City, $4350; Kemp Machinery Co., 223 North Calvert St., Baltimore, Md., $3921, alternate $3824; Niles, Bement & Pond, 111 Broadway, New York City, $4440; Henry Prentiss, 149 Broadway, New York City, $4024; Fairbanks Co., Colorado Bldg., Wash., D. C., $4083; Aumen Machine Co., 107-9 East Lombard St., Baltimore, Md., $4653.

Schedule No. 5227¼, Class 995, 8 plain milling machines, delivery Newport, R. I., from Brown & Sharpe Co., Promenade St., Providence, R. I., bid "A" $2053, bid "B" $1943; Cleveland Milling Machine Co., 18511 Euclid Ave., Cleveland, Ohio, bid "A" $2843; W. Graver Tank Works, 4809 Todd Ave., Chicago, Ill., bid "A" $950; Manning, Maxwell & Moore, 119 West 40th